JOURNAL
OF THE
WASHINGTON ACADEMY OF SCIENCES

VOL. 21 OCTOBER 19, 1931 No. 17

CHEMISTRY.—*Further studies of kolm.*[1] R. C. WELLS and R. E. STEVENS, U. S. Geological Survey.

INTRODUCTION

Swedish kolm, a material resembling oil shale, has recently become of special interest as one of the very few substances whose age can be determined both from fossils and from the lead-uranium ratio. Interest in this material has been stimulated by Professor A. C. Lane, Chairman of the National Research Committee on the Measurement of Geologic Time by Atomic Disintegration, through whose efforts various studies have been made of it, including those described in this paper. One of the significant results is that the lead extracted from the kolm is the purest uranium lead so far found; its atomic weight determined at Harvard by Baxter and Bliss[2] is 206.008, whereas that of ordinary lead is 207.218.

According to Sjögren[3] kolm was known to Cronstedt as early as 1758. It occurs in limestone and alum shale quarries in the form of ellipsoidal nodules several decimeters thick. It was studied chemically by Nordenskiöld,[4] who also sent a sample to Prof. Winkler at Freiberg in 1901. Winkler found the combustible contents of the kolm to occur in the same proportions as in anthracite (about 5 per cent O, 88 per cent C, and 7 per cent H). He also confirmed the presence of free nitrogen (0.50 per cent). The ash consisted mostly of SiO_2, Al_2O_3, and Fe_2O_3, with small quantities of MnO, MgO, CaO, alkalies, and U_3O_8. Nordenskiöld had earlier found sulphur, uranium, and small proportions of nickel, cobalt, copper, molybdenum, vanadium, and the cerium and gadolinium earths. Miss Naima Sahlbom,

[1] Published with the permission of the Acting Director, U. S. Geological Survey. Received August 26, 1931.

[2] Baxter and Bliss. Jour. Am. Chem. Soc. **52**: 4848. 1930.

[3] Hj. Sjögren. Arkiv. Kemi, Mineral. och. geol., Stockholm, 1905, Band 2, Häfte 5, pp. 1–6.

[4] Nordenskiöld. Compt. rend. **120**: 859. 1895.

assistant to Sjögren, identified barium, lead, tin, and lithium in the kolm.

Our sample of kolm, which was received through Professor A. H. Westergaard, was "collected from the middle and lower parts of the Peltura beds of the shale quarry of Gullhogen near Skovde in the province of Westergötland. These beds we consider to be of Cambrian age. Undoubtedly they are of pre-Ordovician age, as the overlying bed is formed by alum shale with *Dictyonema flabelliforme* Elchw." The beds are therefore of Upper Cambrian age.

Some of this material gave roughly 1.8 per cent moisture, 29.5 volatile matter, 43.6 fixed carbon, and 35.1 ash, according to the U. S. Bureau of Mines. Mr. M. F. Connor kindly determined the approximate composition of the ash to be SiO_2 48.68 per cent, Al_2O_3 20.34, Fe_2O_3 20.00, CaO 0.90, MgO 1.40, Na_2O 0.60, K_2O 5.84, SO_3 0.62, TiO_2 0.20, P_2O_5 0.15, undetermined 1.27, with S in the kolm 4.74, and Fe 3.85, as pyrite. Later tests (by R. C. Wells) showed about 0.003 per cent V_2O_5, referred to the kolm, about 0.04 ZnO, 0.13 rare earths, 0.013 Mo, 0.003 MnO, 0.004 NiO and no Zr, Be, or Th. The ash was 31.25 per cent of the weight of the kolm used in the final work. Bismuth and cobalt were not noted, though they might have been present. Titanium and phosphorus were not mentioned by Sjögren.

The uranium in the kolm is supposed by Lindgren to have been segregated by organisms. It appears to be free from thorium. Its percentage was carefully determined by Mauzelius.[5] Later determinations with the electroscope by one of us, also by S. C. Lind, R. B. Moore, and Herman Schlundt, who used the emanation method, indicated somewhat less uranium than that found in the regular analytical way. The cause of this slight discrepancy is not yet entirely clear. Part of the difficulty, however, may consist of freeing the uranium entirely from silica and alumina, or, if the cupferron or titration methods are used, of avoiding the presence of zinc or overreducing the uranium solution previous to titration.

ANALYTICAL DETERMINATIONS

The principal object of the analytical work was to determine the age of the kolm from the ratio of lead to uranium. As the percentages were small this work was very laborious and time consuming. In general the method consisted of (1) getting all the lead in one portion, (2) all the uranium in another portion, and (3) separating each in a pure and determinable form. The method finally used was as follows:

[5] R. Mauselins. Tekn. Tidskr., Uppl. C, Kemi och Bergvet, H. 2, 1914.

About 50 grams of a large finely powdered uniform sample (originally prepared by R. B. Moore) was gently ignited in a platinum dish. The ash was treated with water, about 23 ml. of sulphuric acid, and an excess of hydrofluoric acid and evaporated to fumes. The residue was dissolved in water and again heated to fumes. It was then again dissolved, transferred to a flask, made up to 500 ml., saturated with hydrogen sulphide, heated, cooled, again saturated with hydrogen sulphide, and allowed to stand at least overnight. The solution was then filtered and the precipitate well washed with water containing hydrogen sulphide, whereby all the lead was separated in the impure precipitate from all the uranium in the filtrate with most of the iron and aluminum.

The precipitate containing the lead sulphide was extracted on the filter paper with hot dilute hydrochloric and nitric acids and the solution set on the steam bath to evaporate. The insoluble part, after gently burning off the filter paper, was fused with sodium carbonate, leached with water, and the solution filtered and discarded. The precipitate was dissolved in hot dilute hydrochloric acid, nearly neutralized with sodium carbonate with litmus paper, and heated just to boiling, whereby much of the titanium was precipitated almost free from lead. This was filtered off and the lead in the filtrate precipitated with hydrogen sulphide as before, finally dissolved, and added to the main solution of lead nitrate. The titanium precipitate was reworked by the sulphate method to recover the small quantity of lead in it. All the filter papers used were finally ignited, the ash fused with sodium carbonate, and any lead present recovered in the usual way. The final solution containing all the lead was heated to fumes with a small excess, 0.2 or 0.4 gram, of sulphuric acid, diluted about 20 times, allowed to stand overnight, and filtered, whereby molybdenum and copper were removed. The lead sulphate was then dissolved in hot ammonium acetate solution and the solution allowed to stand overnight and filtered. After collecting traces of lead from all remaining ignited filter papers by means of a fusion, separation as sulphate, and solution in ammonium acetate, the total lead was again precipitated as sulphide, filtered off, dissolved in nitric acid, and converted to sulphate in a weighed porcelain crucible. From this weight was calculated the percentage of lead.

The filtrate containing the iron, aluminum, and uranium was heated with nitric acid to oxidize the iron, neutralized with ammonia, precipitated with ammoniacal ammonium carbonate in excess, and filtered. Two reprecipitations were made to extract all of the uranium. The combined filtrates were evaporated to small bulk, heated with an excess of nitric acid for some time to destroy ammonium salts, diluted, precipitated with ammonia, and the filtrate containing calcium discarded.

The uranium precipitate was tested for rare earths by means of hydrofluoric acid at this point, but no precipitate was obtained. The uranium was then converted to sulphate, diluted to 150 ml., neutralized with sodium carbonate, and an excess of 1.5 grams of sodium bicarbonate added. After heating to boiling the precipitate was filtered off, dissolved in nitric acid, and reprecipitated. As a small quantity of uranium seemed to be persistently retained by the precipitate in some tests the precipitate was dissolved in hydrochloric acid, evaporated nearly to dryness, sodium chloride added, then potassium ferrocyanide in excess. On filtering the precipitate off, washing, transposing

with hot sodium hydroxide solution, filtering, washing, dissolving in nitric acid, and treating again with sodium carbonate and bicarbonate the remaining quantity of uranium passed into the filtrate and was recovered and added to the main portion, which was again converted to sulphate.

The solution was brought to 12 per cent by volume of sulphuric acid, then, after cooling in ice water, a solution of cupferron was added. The small precipitate was filtered off, the cupferron in the filtrate destroyed by nitric acid, the uranium reduced in 4 per cent sulphuric acid in a zinc reductor, brought to 6 per cent sulphuric acid, then precipitated by cupferron, filtered off and ignited. This material was dissolved in nitric acid, a slight quantity of insoluble material filtered off, the solution diluted, boiled, and cooled and the uranium again precipitated with ammonia to eliminate zinc sulphate, filtered off, ignited and weighed as U_3O_8. From the weight was calculated the percentage of uranium, as shown in Table 1.

TABLE 1.—LEAD-URANIUM RATIO OF THE KOLM.
(By R. C. Wells.)

Experiment	*Pb Per cent*	*U Per cent*
1	0.0261	—
2	—	0.440
3	.0264	—
4	.0268	.412
5	—	.442
6	—	.425
Weighted mean	0.0264	0.432

Pb:U = 0.061

The figure for U in experiment 4 is given only half weight, as presumably some uranium was lost.

Owing to uncertainties in the factor a simple formula will suffice to calculate the age for the present.

$$\text{Age} = \frac{\log (U + 1.156\ Pb) - \log U}{6.5 \times 10^{-5}} \text{ million years}$$

This gives 458 million years, which is a little lower than the figure generally ascribed to the Cambrian, 500 to 600 million years, thus tending very slightly to shorten up the Paleozoic and bring the pre-Cambrian a little nearer.[6]

[6] After the work described above was completed some tests of the precipitation of uranous salts by cupferron made by J. G. Fairchild in the Survey laboratory indicated that the results tend to come a little low, possibly as much as 4 or 6 milligrams of U_3O_8. The question needs further study, and by several analysts. If a correction on this account is applicable it might raise the uranium percentage given above to 0.445, but the size of the correction is not yet definitely established and it should not be applied until the matter is investigated in greater detail.

PERMEABILITY OF THE KOLM TO GASES

(R. E. Stevens)

The low results generally found for the age of minerals by the helium-lead ratio, and usually ascribed to a loss of helium, made it of interest to see how permeable the kolm might be to gases.

For the measurement of diffusion through kolm use was made of the apparatus previously described by one of us.[7] It consists essentially of two glass chambers between which is sealed the specimen to be tested. After the apparatus has been evacuated, one of the chambers is filled with gas at atmospheric pressure. By means of manometer tubes readings are taken, at intervals, of the pressure in each chamber, from which the volume of gas diffused and the permeability of the sample may be calculated.

The very small permeability of the kolm made the presence of leaks a grave source of error, and much time and care was taken in assembling and testing the apparatus. The specimen of kolm was sealed between the two chambers and the junction heavily coated with sealing wax. Two coats of shellac were added. Both chambers were then evacuated and pressure readings taken over a four-day period, showing an increase in pressure of 3 mm. The pressure seemed to reach a steady value after one day, and it appeared evident that the change was due to escape of gas held within the kolm. For this reason the apparatus was first allowed to stand evacuated for a day before making a determination.

Decreasing the size of the chambers in order to increase the sensitivity made it necessary to determine, in each test, the change in volume due to displacement in the mercury columns. The size of manometer tubes was measured, as well as the volume of the chambers, so that corrections could be applied.

In conjunction with the readings of the mercury columns, the temperature and barometric pressure were noted, pressure within the chambers being obtained by difference. The volume of gas in each chamber was then reduced to standard conditions. Decreases in volume in one of the chambers were in good agreement with increases in the other. and an average was taken as the volume of gas diffused.

The results of experiments with air and with hydrogen are given in Table 2. In the last column is tabulated the permeability constant, k, for the kolm. In the formula for k, V is the volume of gas diffused, L and A the length and area, respectively, of the kolm specimen, M

[7] R. C. Wells. This JOURNAL 19: 321. 1929.

the molecular weight of the gas, $p_1 - p_2$ the average pressure gradient in atmospheres, and T is the time in hours.

There is a small difference in the value of k obtained with the two gases. This may be due in part to the fact that air is a mixture of gases and some fractionation may have occurred. Another small variation may be caused by the relative viscosities of the two gases.

A conception of the dense nature of kolm is obtained by comparison with the previous study[8] of diffusion through ball clay with the same apparatus. The value of k for ball clay was found to be over 600,

TABLE 2.—PERMEABILITY OF KOLM TO GASES
(By R. E. Stevens.)

Gas used	Time (hours)	At right of plug		At left of plug		Volume, V, diffused at 760 mm. (ml.)	Average pressure gradient in atmospheres ($p_1 - p_2$)	$k = \frac{VLM}{(p_1 - p_2)A.T.}$
		Pressure, p_1 (mm.)	Volume at 760 mm. and 0°C. (ml.)	Pressure, p_2 (mm.)	Volume at 760 mm. and 0°C. (ml.)			
Air	0	0.5	0.01	764	58.5	7.40	0.87	0.032
	48	113.0	7.61	675	51.1	2.95	.69	.033
	24	154.0	10.40	640	48.0	2.45	.60	.031
	24.5	189.0	12.90	611	45.6	2.10	.52	.032
	23.5	217.0	14.80	583	43.3			
Hydrogen	0	2.0	0.13	767.5	58.9	2.25	.968	.028
	4	38.0	2.52	742.5	56.8	8.00	.788	.025
	20	157.0	10.66	649.5	48.9	6.70	.533	.026
	24	246.5	17.00	564.0	41.8	6.85	.299	.023
	48	341.0	23.92	477.5	35.0			

Molecular weight of air = 29.0 Molecular weight of hydrogen = 2.02
Dimensions of kolm: Diameter = 2.92 cm.; thickness = 0.23 cm.

with time expressed in hours, as compared with 0.03 for the kolm. Even with the small permeability found for kolm it is assumed that the gas must have passed through pores and not through the material of the kolm itself (as helium seems to pass through silica glass). Moreover the experiments were made at relatively low pressures after pumping out most of the moisture in the material.

SUMMARY

1. The lead-uranium ratio of Swedish kolm is found to be 0.061, a figure that will enable Cambrian time to be dated when certain factors are determined more accurately. Provisionally it gives about 460 million years.

2. The kolm is found to have a very low permeability to gases, 0.03, as compared with 600 for a ball clay previously studied.

[8] *Loc. cit.* p. 325.

PALEONTOLOGY.—*Contributions to the paleontology of Peru, V.* Nodosaria pozoensis *W. Berry, n. sp.*[1] WILLARD BERRY. (Communicated by EDWARD W. BERRY.)

During the course of examining numerous well samples from the Tertiary of Northwest Peru, I commonly found separate chambers of a species of *Nodosaria.* Occasionally several were found together but more often they were widely scattered throughout the sample. In examining the samples from one well a larger piece of cutting yielded a nearly complete specimen. This specimen, which was slightly damaged in cleaning, was found in hard, gray, slightly sandy shale or "grada." This species is probably from the Negritos formation (?) of the Eocene. The exact horizon is questionable due to the lack of exact correlation of the wells in this older part of the Eocene.

This organism must have lived in fairly quiet waters as evidenced by its extremely weak structure. That the water was fairly deep or else was not affected by a large run off is shown by the fineness of the shale. The species may be described as follows.

Fig. 1. *Nodosaria pozoensis* W. Berry, × 3.

Nodosaria pozoensis W. Berry, n.sp.

Test large elongate, very slightly curved, untapered, composed of more than 13 chambers, initial end rounded, (broken in cleaning type) apertural end always missing, sutures straight, distinct, depressed; walls costate, costae not running from chamber to chamber but stopping at each suture and not lining up exactly, the younger chambers having less costae, chambers inflate. Usually found as separate chambers.

Length, 10 mm.; diameter, 0.75 mm.

Nodosaria pozoensis has the general appearance of *N. raphanus* (Linnaeus) but lacks the pointed initial end and is larger with a larger number of costae on each chamber. This species is easily recognized even in the separate chambers by the heavy costae and the almost round character of the chambers.

Locality—Eocene well # 1920, depth 1980 feet, Negritos, Peru.

[1] Work carried out under a grant in aid from the National Research Council. Received August 26, 1931.

ZOOLOGY.—*New pocket gophers from Arizona and Utah.*[1] E. A. GOLDMAN, U. S. Biological Survey.

During recent years many additional specimens of pocket gophers from typical regions and from localities tending to fill gaps in geographic ranges, as previously known, in Arizona and adjoining territory have been acquired. Study of this material has afforded a clearer concept of the status and relationships of the numerous forms inhabiting the highly diversified general area.

Leaving *Thomomys fossor*, a representative of a well marked group apart, out of consideration, the pocket gophers of Arizona are currently assigned to two groups. These are the "*perpallidus*" and "*fulvus*" groups respectively. In revising the genus *Thomomys* Bailey (North Amer. Fauna, No. 39, p. 33, Nov. 15, 1915) aligns these groups as follows: "The *perpallidus* group includes mainly pale desert forms with very small ears, but has no very distinctive group characters. . . . The *fulvus* group includes several mountain forms of rather bright tawny shades, and paler tawny valley forms in the surrounding country." He also says: "The *bottae* group is large, variable, and not sharply separated from the *perpallidus* and *fulvus* groups; all of them agree in number and arrangement of mammae, short ears, and many other characters."

Passing in review the material now available the writer is forced to the conclusion that not only are there no characters warranting the recognition of *T. perpallidus* and *T. fulvus* as separate groups, but they are united by forms so closely interrelated that even specific distinction disappears. Complete intergradation is evident in some cases and the kind and combination of characters presented indicate such close relationships that it can safely be assumed in others.

The ranges of a chain of forms connecting *perpallidus* and *fulvus* extend across the lower part of the Colorado River valley, interrupted by the river channel. The valley is inhabited on the two sides by forms that differ only slightly in average characters, some individuals being indistinguishable. This close alliance is readily understood when it is remembered that, from time to time, shifting channels along the lower Colorado transfer areas of considerable size from one side to the other.

[1] Received September 3, 1931.

The near relationship of *perpallidus* and *fulvus* is clear, but it seems best in the present faunal treatment of pocket gophers arbitrarily to draw a line between the two at the Colorado River rather than to invite the confusion that would result through an attempt to transfer all of the forms of *perpallidus* to *fulvus*, the older name. Incidentally, general comparisons strongly indicate that forms currently placed under *perpallidus* and *fulvus* may eventually have to be listed as subspecies of *bottae*, a still older name. In order to avoid confusion in describing new subspecies the following forms from east of the Colorado River currently assigned, except *cervinus*, to *perpallidus* are transferred to *fulvus:*

Thomomys fulvus chrysonotus Grinnell
Ehrenberg, Yuma County, Arizona.
Thomomys fulvus cervinus Allen
Phoenix, Maricopa County, Arizona.
Thomomys fulvus aureus Allen. . . Bluff City, San Juan County, Utah.
Thomomys fulvus apache Bailey
Lake La Jara, Jicarilla Indian Reservation, New Mexico.

Pocket gophers inhabit nearly every part of Arizona and adjoining territory, but the ranges even of subspecies are irregularly interrupted owing to rock formations, adverse soil, food, or other conditions. The multiplicity of forms appears to be the expression of environmental factors and the sedentary habits of the group. Some occupy extensive ranges and others are quite restricted. Habitats vary from alluvial river bottoms and sterile desert plains near sea level to high forested plateaus and rugged mountains, often rising abruptly to high elevations.

Descriptions of New Subspecies

Thomomys fulvus flavidus subsp. nov.

Golden Pocket Gopher

Type.—From Parker, Yuma County, Arizona (altitude 350 feet). No. 181065, ♂ adult, U. S. National Museum (Biological Survey collection), collected February 1, 1913, by E. A. Goldman. Original number 21810.

Distribution.—Known only from alluvial bottom lands along the Colorado River in the vicinity of the type locality.

General characters.—A large ochraceous buff or golden yellowish subspecies with an angular, massive skull. Similar in color to *Thomomys fulvus chrysonotus* (somewhat paler than the type), but upper parts clearer ochraceous buff; under parts, especially inguinal region, and hind limbs all around irregularly marked by pure white areas, the white extending to roots of hairs (these parts in *chrysonotus* plumbeous basally); skull very similar but exhibiting a departure in detail. Allied to *Thomomys fulvus desertorum* but larger, much paler

and cranial characters distinctive. Very similar in general color and superficially resembling the geographically removed form, *Thomomys fulvus aureus;* upper parts more uniform rather pale ochraceous buff (varying to richer buffy tones, with dorsum moderately overlaid with black in *aureus*); under parts with irregular white markings (normally absent in *aureus*); skull more angular and massive and differing in important details.

Color.—Type (winter pelage): Upper parts near ochraceous buff or golden yellow, the back scarcely modified by dark-tipped hairs, becoming light ochraceous buff on sides; under parts in general overlaid with light ochraceous buff, the basal color plumbeous, irregularly and extensively invaded on inguinal region by pure white, the white extending to roots of hairs and including hind limbs all around; a pure white pectoral spot; black auricular spots small, not reaching anterior part of ear; feet and tail thinly clothed with whitish hairs. *Young* (in first pelage): Light ochraceous buff above, creamy white below.

Skull.—Very similar in general to that of *T. f. chrysonotus*, but larger; supraoccipital region indented mesially and more distinctly concave in transverse section over foramen magnum; auditory meatus opening more widely; mastoid process of squamosal less deflected forward; auditory and mastoid bullae large and fully inflated and dentition heavy as in *chrysonotus*. Similar to that of *T. f. desertorum* but larger, more angular and massive; auditory and mastoid bullae larger, more fully rounded; mastoid bullae more swollen and bulging posteriorly, and less broadly overlapped by exoccipitals; dentition similar but heavier. Compared with that of *T. f. aureus* the skull is similar in size, but more angular and massive; maxillary arm of zygoma heavier; nasals longer and broader posteriorly; ascending branches of premaxillae narrower, more tapering posteriorly; pterygoids broader; interpterygoid space more narrowly V-shaped (more or less distinctly U-shaped in *aureus*); auditory meatus opening more widely; paroccipital process in adult male more strongly overlapping auditory bulla; bullae large and swollen, and dentition much as in *aureus*.

Measurements.—Type: Total length, 249 mm.; tail vertebrae, 83; hind foot, 33. Average of three adult male topotypes: 238 (232–250); 75 (66–86); 33.5 (32.5–34.5). Average of nine adult female topotypes: 221 (210–236); 70 (57–78); 32 (31–32.5). *Skull* (type): Condylobasal length, 41.7; zygomatic breadth, 27.2; greatest breadth across squamosals (over mastoids), 21.8; interorbital constriction, 6.8; length of nasals, 15; alveolar length of upper molariform tooth row, 8.8.

Remarks.—The clear, nearly uniform golden yellowish general color and extensive pure white areas irregularly invading the under parts and usually involving both hind legs well up toward the hips all around distinguish this form externally from its near relatives. It bears a rather close superficial resemblance to *aureus*, but the ranges of the two are completely separated by those of interposed forms.

Specimens examined.—Sixteen, all from the type locality.

Thomomys fulvus modicus subsp. nov.

Type.—From La Osa (near Mexican Boundary), southern end of Altar Valley, Pima County, Arizona. No. 59203, ♂ adult, U. S. National Museum, collected by E. A. Mearns and F. X. Holzner, December 14, 1893. Original number 2681.

Distribution.—Desert plains and valleys of central southern Arizona, and probably adjoining parts of Sonora, Mexico.

General characters.—Closely allied to *Thomomys fulvus cervinus* of the Salt River Valley, but smaller, color darker, near wood brown instead of vinaceous buffy or fawn color in winter pelage; cranial characters distinctive. Related to *Thomomys fulvus chrysonotus* of the lower Colorado River Valley, but prevailing color wood brownish instead of pale ochraceous buffy; skull differing in detail. Similar in general to *Thomomys fulvus toltecus* of Chihuahua, but color duller, wood brownish instead of rich ochraceous buffy in winter pelage; skull more slender in form.

Color.—Type (winter pelage); Upper parts near wood brown, purest along sides, thinly overlaid with dusky on head and over back; under parts pale ochraceous buffy, the plumbeous basal color showing through; ears encircled by conspicuous deep black areas; forearms, feet, and tail whitish. Some specimens in worn summer pelage are rich ochraceous buffy above.

Skull.—Similar in general form to that of *T. f. cervinus* but smaller and of slenderer proportions; rostrum narrower, more constricted or compressed laterally in front of zygomata; nasals narrower; jugal shorter. Compared with those of *T. f. chrysonotus* and *T. f. toltecus* the skull is less massive than either; maxillary arm of zygoma sloping more strongly backward; jugal shorter, the result being a distinct shortening of the outer side of the zygoma, rostrum and nasals more slender; incisors narrower.

Measurements.—Type: Total length, 238; tail vertebrae, 79; hind foot, 30. Average of four adult male topotypes: 214 (204–222); 67 (55–75); 28 (25.5–30). Average of six adult female topotypes: 208 (198–224); 69 (60–74); 27.5 (26.5–28). *Skull* (type): Condylobasal length, 40.5; zygomatic breadth, 25; greatest breadth across squamosals (over mastoids), 20; interorbital constriction, 6.7; length of nasals, 13.7; alveolar length of upper molariform tooth row, 8.

Remarks.—While *modicus* is usually much larger than *intermedius* and differs widely in color, the skulls of some females, especially, are similar in size in the two forms, and in other respects indicate probable intergradation. This desert race tends to bridge the gap between *chrysonotus*, the pallid subspecies inhabiting the region east of the lower Colorado, and the darker forms occupying the higher country in southeastern Arizona. It partakes also of the characters of *cervinus*, the lighter colored, more robust animal of the Salt River Valley.

Specimens examined.—Total number, 20, all from Arizona as follows: Calabasas, 1; Fort Lowell, 2; Indian Oasis, Baboquivari Valley, 2; La Osa (type locality), 11; Tucson, 4.

Thomomys fulvus catalinae subsp. nov.

Santa Catalina Mountain Gopher

Type.—From Summerhaven, Santa Catalina Mountains, Pima County, Arizona (altitude 7,500 feet). No. 244081, ♂ adult, U. S. National Museum (Biological Survey collection), collected by E. A. Goldman, August 6, 1923. Original number 23517.

Distribution.—Known only from the upper slopes of the Santa Catalina Mountains, Arizona.

General characters.—A small, dark, richly colored subspecies. Allied to *Thomomys fulvus toltecus*, but smaller, much darker, with a narrower, less massive skull. Similar in general to *Thomomys fulvus intermedius* of the Huachuca Mountains, but larger; color of upper parts more uniform, without

the broad, blackish median dorsal area usually continuous from head to base of tail in *intermedius*, and sides brighter, more tawny; cranial characters distinctive.

Color.—Type (summer pelage): Upper parts between tawny and ochraceous tawny, clearest on lower part of sides, the top of head and back heavily mixed with black, the black predominating on middle of face; under parts over laid with light tawny, the under color everywhere dark plumbeous; ears completely within deep black spots; feet and tail thinly clothed with dull whitish hairs. Some specimens exhibit small median dorsal blackish areas.

Skull.—Narrower and less massive than that of *T. f. toltecus*; zygomata more slender and much less widely spreading; dentition similar. Compared with that of *T. f. intermedius* the skull is larger; rostrum less constricted in front of zygomata; nasals broader, less wedge-shaped posteriorly; auditory bullae larger, more smoothly and evenly rounded (more or less distinctly truncate anteriorly in *intermedius*).

Measurements.—Type: Total length, 218; tail vertebrae, 65; hind foot, 31. Average of four adult male topotypes: 211 (204–220); 64 (58–72); 28.5 (27.5–30). Average of four adult female topotypes: 202 (196–212); 59 (55–62); 25 (24–26). *Skull* (type): Condylobasal length, 38.6; zygomatic breadth, 23.8; greatest breadth across squamosals (over mastoids), 19.5; interorbital constriction, 6.5; length of nasals, 13; alveolar length of upper molariform tooth row, 8.1.

Remarks.—T. f. catalinae somewhat resembles its geographic neighbor *intermedius* but the upper parts are richer, more tawny instead of cinnamon brownish, and the general color is more uniform, without the broad blackish median dorsal area normally extending from top of head to base of tail in *intermedius*. It is probably restricted to the Santa Catalina Mountains which rise island-like from the desert plains.

Specimens examined.—Ten, all from the type locality.

Thomomys fulvus grahamensis subsp. nov.

Graham Mountain Pocket Gopher

Type.—From Graham Mountains (Pinaleno Mountains on some maps) Graham County, Arizona (altitude 9,200 feet). No. 204313, ♂ adult, U. S. National Museum (Biological Survey collection), collected by E. G. Holt, June 7, 1914. Original number 269.

Distribution.—Known only from the upper slopes (6,100–9,200 feet altitude) of the Graham Mountains, Arizona.

General characters.—Closely allied to *Thomomys fulvus toltecus*, but color darker; skull narrower. Resembling *Thomomys fulvus fulvus* of the high plateau region in color, but duller, less ochraceous tawny; skull differing in detail. Similar in size to *Thomomys fulvus catalinae* but lighter, the sides of body ochraceous buffy instead of ochraceous tawny; combination of cranial features distinctive. Differing from *Thomomys fulvus intermedius* in decidedly larger size, lighter color and well-marked skull characters.

Color.—Type (summer pelage): Upper parts dark ochraceous buff, purest along sides, rather heavily mixed with black on top and sides of head and over dorsum, the dark hairs becoming somewhat thinner on rump; face blackish; ears encircled by deep black; under parts overlaid with light ochraceous buff, the basal color plumbeous everywhere; feet dull whitish; tail whitish, interrupted by irregular dusky sections above.

Skull.—Similar to that of *T. f. toltecus*, but narrower; braincase narrower; zygomata much less widely spreading; maxillary arm of zygoma more slender, the external angle narrower and less prominent; jugal less expanded anteriorly and more strongly inclined upward to point of union with maxilla; auditory bullae smaller; dentition very similar. Similar to that of *T. f. fulvus*, but narrower and flatter; zygomata much less widely spreading; auditory bullae rather small, much as in *fulvus*. Not very unlike that of *T. f. catalinae* in size and general form, but rostrum deeper; jugal slanting more strongly upward from squamosal to point of union with maxilla (jugal more nearly horizontal in *catalinae*) bullae slightly smaller. Compared with that of *T. f. intermedius* the skull is larger and heavier; nasals broader posteriorly; rostrum less constricted or compressed laterally in front of zygomata; ascending branches of premaxillae broader posteriorly; auditory bullae larger, more smoothly rounded.

Measurements.—Type: Total length, 231; tail vertebrae, 71; hind foot, 29. Two adult male topotypes: 217, 225; 68, 68; 27, 28. Two adult female topotypes: 215, 228; 69, 76; 27, 28. *Skull* (type): Condylobasal length, 38.3; zygomatic breadth, 23.3; greatest breadth, across squamosals (over mastoids), 19.2; interorbital constriction, 7.5 length of nasals, 13.8; alveolar length of upper molariform tooth row, 8.5.

Remarks.—The present form appears to be restricted to the upper slopes of the Graham Mountains, doubtless intergrading lower down with *toltecus* which inhabits the Gila Valley and neighboring areas. In general color it somewhat resembles typical *fulvus* but the ranges of the two are separated by an arm of that of *toltecus* along the Gila River valley, and distinctive characters have been pointed out.

Specimens examined.—Ten, all from the Graham Mountains, Arizona.

Thomomys fulvus collinus subsp. nov.

Chiricahua Mountain Pocket Gopher

Type.—From Fly Park, Chiricahua Mountains, Cochise County, Arizona (altitude 9,000 feet). No. 66053, ♂ adult, U. S. National Museum (Biological Survey collection), collected by A. K. Fisher, June 10, 1894. Original number 1527.

Distribution.—Known only from the upper slopes of the Chiricahua Mountains, Arizona.

General characters.—Closely allied to *Thomomys fulvus toltecus*, but smaller and darker; skull of lighter proportions. Similar in size and color to *Thomomys fulvus grahamensis*, but skull more slender. About like *T. f. catalinae* in size, but color much lighter, the sides ochraceous buffy instead of rich tawny, and skull differing in detail.

Color.—Type (summer pelage): Upper parts dark ochraceous buff, purest along sides, rather heavily mixed with black on top of head and over back; under parts overlaid with rich ochraceous buff, the hairs plumbeous at base; feet and tail whitish. In one specimen from 7,500 feet altitude the under parts are creamy white.

Skull.—Not very unlike that of *T. f. toltecus* but smaller, relatively narrower, less massive. Similar in size to that of *T. f. grahamensis*, but more slender in form; rostrum, braincase, and interorbital constriction usually narrower; nasals narrower; jugal nearly horizontal (not distinctly inclined upward anteriorly as usual in *grahamensis*); auditory bullae larger; incisors

usually narrower. Compared with that of *T. f. catalinae* the skull is similar in size and form but is usually narrower; rostrum more slender; bullae usually smaller; dentition about the same.

Measurements.—Type: Total length, 225; tail vertebrae, 68; hind foot, 29. Two adult males from Pinery Canyon (altitude 7,500 feet), Chiricahua Mountains: 210, 190; 74, 60; 27, 26. Two adult females from same locality: 200, 190; 74, 62; 27, 27. *Skull* (type): Condylobasal length, 39; zygomatic breadth, 24; greatest breadth across squamosals (over mastoids), 19.8; interorbital constriction, 6.6; length of nasals, 12.4; alveolar length of upper molariform tooth row, 8.3.

Remarks.—T. f. collinus is a small dark high mountain subspecies readily distinguished from the larger lighter ochraceous *toltecus* of the neighboring plains. Specimens from the mouth of Turkey Creek at 5,000 feet altitude are dark in color, but the skulls are heavier than in typical *collinus* and indicate gradation toward *toltecus*. The present form resembles *grahamensis* externally but differs in combination of cranial characters, and the ranges of the two are separated by an arm of that of *toltecus*.

Specimens examined.—Total number, 24, all from the Chiricahua Mountains, Arizona, as follows: Fly Park, 1 (type); Pinery Canyon (7,500 feet), 6; Rucker Canyon, 6; Turkey Creek (mouth, 5,000 feet), 11.

Thomomys fulvus pusillus subsp. nov.

Coyote Mountain Pocket Gopher

Type.—From Coyote Mountains, Pima County, Arizona (altitude 3,000 feet). No. 209290, ♀ adult, U. S. National Museum (Biological Survey collection), collected by E. A. Goldman, September 4, 1915. Original number 22722.

Distribution.—Known only from the Coyote Mountains; probably inhabiting other desert mountain ranges of central southern Arizona.

General characters.—A small, rich ochraceous tawny form with a slender, delicate skull and large, fully distended bullae. Similar in size to *Thomomys fulvus intermedius*, but general color above rich ochraceous tawny (without a broad blackish median dorsal line) instead of cinnamon brown, and cranial characters, especially form of zygomata and large bullae, quite distinctive. Much smaller than *Thomomys fulvus modicus*, color richer, more tawny, and skull differing in detail.

Color.—Type: Upper parts between tawny and ochraceous tawny, purest along sides, the top of head and back somewhat darkened by black-tipped hairs; muzzle blackish; black auricular spots small, encircling entire ears; under parts ochraceous buffy; feet white; tail grayish dusky above, whitish below.

Skull.—Similar in size and general form to that of *T. f. intermedius*, but flatter; zygomata diverging and widest anteriorly (instead of posteriorly as in *intermedius*); nasals broader posteriorly, the ends emarginate as usual in *intermedius;* premaxillae narrower posteriorly; basioccipital narrower; auditory and mastoid bullae much larger, more swollen and smoothly rounded; molariform toothrows shorter. Compared with that of *T. f. modicus* the skull is very much smaller and flatter; zygomata widest anteriorly instead of posteriorly; auditory and mastoid bullae similarly inflated.

Measurements.—Type: Total length, 201; tail vertebrae, 65; hind foot, 27.5. *Skull* (type): Condylobasal length, 32.6; zygomatic breadth, 19.7; greatest breadth across squamosals (over mastoids), 17.1; interorbital con-

striction, 6.2; length of nasals, 11; alveolar length of upper molariform tooth row, 6.8.

Remarks.—This small desert-mountain form approaches *intermedius* in size, but in the sum of its characters is more nearly related to the much larger lowland subspecies *modicus*. It may be expected to occur in other desert mountain ranges in the region of the type locality. It is based on a single specimen which presents cranial characters that appear to be quite distinctive.

Thomomys fulvus peramplus subsp. nov.

Tunicha Mountain Pocket Gopher

Type.—From Wheatfield Creek, west slope of Tunicha Mountains, Apache County, northwestern Arizona (altitude 7,000 feet). No. 247632, ♂ adult, U. S. National Museum (Biological Survey collection), collected by Paul Trapier, June 23, 1927. Original number 720.

Distribution.—Mountains of northeastern Arizona and northwestern New Mexico (altitude 7,000–8,800 feet).

General characters.—A large dark-colored subspecies closely resembling *Thomomys fulvus apache*, of northern New Mexico, but upper parts still duller, the sides vinaceous instead of dull ochraceous buffy; skull more elongated and presenting a departure in detail. Contrasting strongly with *Thomomys fulvus aureus* of southeastern Utah in dark, dull coloration, but cranial characters indicate close relationship and the two doubtless intergrade along the basal slopes of the mountains. Color much duller than *Thomomys fulvus fulvus* of the high plateau region of Arizona, and skull quite distinctive.

Color.—Upper and under parts near vinaceous buff, clearest along sides, the top of head and posterior part of back blackish; dark plumbeous basal color tending to show through nearly everywhere and accentuating the dull general tone; black auricular spots inconspicuous, nearly confluent with general color of dorsum; ankles dusky; fore feet grayish or light brownish; hind feet white; tail above clothed with brownish hairs on proximal half, becoming white beyond to tip and whitish below.

Skull.—Closely aproaching that of *T. f. aureus* but rostrum longer; nasals broader posteriorly and premaxillae correspondingly reduced. Similar to that of *T. f. apache*, but more elongated; rostrum decidedly longer; nasals longer and broader posteriorly, less wedge-shaped; premaxillae narrower posteriorly; interorbital constriction narrower; bullae large and rounded, about as in *apache*. Compared with that of *T. f. fulvus* the skull is similar in general form, but larger, more angular and massive; nasals less wedge-shaped, broader posteriorly, the ends irregularly truncate instead of emarginate; auditory bullae much larger, bulging farther below basioccipital; dentition heavier.

Measurements.—Type: Total length, 260; tail vertebrae, 80; hind foot, 35. Average of four adult male topotypes: 246 (240–255); 80 (60–90); 35 (34–37). Average of six adult female topotypes: 230 (225–240); 75 (65–88); 32 (31–33). *Skull* (type): Condylobasal length, 45.6; zygomatic breadth, 28; greatest breadth across squamosals (over mastoids), 23; interorbital constriction, 6.7; length of nasals, 16.8; alveolar length of upper molariform tooth row, 8.8.

Remarks.—In dark, dull coloration this high-mountain form resembles *apache*, but in cranial characters reveals closer relationship to the vividly tinted subspecies *aureus* of the surrounding deserts. Its known vertical range is from 7,000 to 8,000 feet. At the type locality it occurs in close proximity to

the distinct species, *Thomomys fossor*, which seems to replace it at about 9,000 feet altitude along the crest of the Tunicha Mountains.

Specimens examined.—Total number, 33, as follows:
Arizona: Canyon de Chelly (7 miles above mouth), 1; Fort Defiance (12 miles northwest), 1; Saint Michaels, 2; Tunicha Mountains (type locality), 16. New Mexico: Chusca Mountains, 13.

Thomomys perpallidus osgoodi subsp. nov.

Type.—From Hanksville, Wayne County, Utah. No. 158530, ♂ adult, U. S. National Museum (Biological Survey collection), collected by W. H. Osgood, October 20, 1908. Original number 3701.

Distribution.—Fremont River Valley near Hanksville, Utah; limits of range unknown.

General characters.—A very light ochraceous buffy or light yellowish form with a rather massive skull. Somewhat resembling *Thomomys fulvus aureus* from Bluff, San Juan County, Utah, but upper parts contrasting in decidedly lighter ochraceous buffy tones, and cranial characters distinctive. Related to *Thomomys perpallidus planirostris* from Zion National Park, but much paler, and skull differing in important features, especially the arched instead of flattened or depressed upper surface near anterior roots of zygomata.

Color.—*Type* (winter pelage): Upper parts very light ochraceous buff, richest on posterior part of back, unmodified by dark-tipped hairs present in most related forms; middle of face, nose, and area near mouth indistinctly dusky; under parts and well up on flanks and outer sides of limbs creamy white; black auricular spots small, but conspicuous and completely encircling ears; feet and tail white. Five other specimens are practically identical in color.

Skull.—Similar in general form to that of *T. f. aureus*, but smaller; occipital region more smoothly rounded above, tending to bulge posteriorly below slightly developed lambdoid crest; premaxillae narrower posteriorly and tapering to a more acute point; sides of zygomata more or less distinctly bowed inward near middle (sides more nearly straight in *aureus*); interpterygoid fossa more narrowly V-shaped (usually more nearly U-shaped in *aureus*); basioccipital shorter; bullae slightly smaller, but fully inflated; dentition about the same. Compared with that of *T. p. planirostris* the skull is arched, instead of flattened or depressed, and more or less distinctly concave in cross section along the median line near anterior roots of zygomata; occipital region more projecting posteriorly below lambdoid crest; auditory bullae larger, more distended below level of basioccipital.

Measurements.—*Type:* Total length, 233; tail vertebrae, 72; hind foot, 30.5. Two adult male topotypes: 215, 225; 68, 70; 29, 29. Average of three adult female topotypes: 197 (184–203); 58 (51–63); 27 (27–27.5). *Skull* (type): Condylobasal length, 39; zygomatic breadth, 24.2; greatest breadth across squamosals (over mastoids), 20.3; interorbital constriction, 6.9; length of nasals, 13.8; alveolar length of upper molariform tooth row, 8.

Remarks.—*T. p. osgoodi* superficially resembles *aureus*, but is lighter yellowish and in cranial characters presents a marked departure. Moreover, it is separated from *aureus* by the effective barrier of the Colorado River. It is a well marked subspecies more closely allied to *planirostris* and other forms inhabiting the territory north and west of the Colorado River.

Specimens examined.—Six skins and skulls and two skulls without skins, all from the type locality.

Thomomys perpallidus dissimilis subsp. nov.

Henry Mountain Pocket Gopher

Type.—From east slope of Mount Ellen, Henry Mountains, Garfield County, Utah (altitude 8,000 feet). No. 158526, ♀ adult, U. S. National Museum (Biological Survey collection), collected by W. H. Osgood, October 15, 1908. Original number 3677.

Distribution.—Known only from the type locality; probably generally distributed over the upper slopes of the Henry Mountains.

General characters.—Closely allied to *Thomomys perpallidus osgoodi* but upper parts near light buff, instead of light ochraceous buff, and skull differing in detail. Similar in general to *Thomomys fulvus aureus* but smaller, light buffy color contrasting strongly with rich ochraceous buff of *aureus*, and cranial characters distinctive. Differing from *Thomomys perpallidus planirostris* in pallid coloration, and important cranial features.

Color.—*Type* (winter pelage): Upper parts near light buff, faintly darkened along the median dorsal area by dusky-tipped hairs; muzzle dusky; black auricular spots small, but including entire ears; under parts, forearms and hind legs creamy white; feet and tail whitish. *Young* (in first pelage): Similar to type but inclining toward light ochraceous buff on top of head, neck, and shoulders.

Skull.—Most closely resembling that of *Thomomys perpallidus osgoodi*, but more elongated; rostrum longer; zygomata more slender, more strongly converging anteriorly; bullae less rounded, more compressed laterally; incisors pale, the ends less recurved. Compared with that of *T. p. planirostris* the skull is arched, instead of flattened or depressed and more or less distinctly concave in cross section along the median line near anterior roots of zygomata; occipital region more projecting posteriorly below lambdoid crest; zygomata narrower, more slender, more strongly converging anteriorly; auditory bullae more elongated, more compressed laterally and projecting below level of basioccipital. Similar in general to that of *T. f. aureus*, but smaller, more slender, and differing in important details as follows: Occipital region more smoothly rounded above, tending to bulge posteriorly below lambdoid crest; zygomata narrower, more slender and converging anteriorly; interpterygoid fossa more narrowly V-shaped; auditory bullae narrower, less fully inflated; teeth smaller, the incisors less recurved.

Measurements.—*Type:* Total length, 211; tail vertebrae, 60; hind foot, 27. *Skull* (type): Condylobasal length, 37; zygomatic breadth, 21.6; greatest breadth across squamosals (over mastoids), 18.8; interorbital constriction, 6.8; length of nasals, 12.2; alveolar length of upper molariform tooth row, 7.6.

Remarks.—Pocket gophers from high mountains are usually dark, but *T. p. dissimilis* is remarkable for its pallid coloration. Near relationship to *osgoodi* of the adjoining Fremont River Valley is evident but the unusual color and the combination of cranial characters are distinguishing features.

Specimens examined.—Three, from the type locality.

Thomomys perpallidus absonus subsp. nov.

Houserock Valley Pocket Gopher

Type.—From Jacob's Pools, Houserock Valley, Coconino County, northern Arizona (altitude 4,000 feet). No. 250016, ♂ adult, U. S. National Museum

(Biological Survey collection), collected by E. A. Goldman, June 7, 1931. Original number 23569.

Distribution.—Known only from the type locality.

General characters.—A dull grayish buffy subspecies of medium size, with a narrow, slenderly formed skull. Closely allied to *Thomomys perpallidus planirostris* but paler, with differential cranial characters, especially the higher midline of the fronto-nasal region. Similar in general to *Thomomys perpallidus osgoodi* and *Thomomys perpallidus dissimilis*, but much darker, and skull presenting a different combination of characters.

Color.—Type (acquiring summer pelage): Upper parts near light ochraceous buff, purest along sides, thinly mixed over top of head and back with pale dusky hairs producing a dull rather grayish buffy combined effect; muzzle dusky; black postauricular spots rather large, extending forward to include anterior margins of ears; under parts overlaid with pale ochraceous buff; forearms, ankles, and feet whitish; tail whitish, becoming pale buffy above near base. In some specimens the under parts vary to light ochraceous buff.

Skull.—Similar in general structure to that of *Thomomys perpallidus planirostris*, but of slenderer proportions, the zygomata very weak, and the lambdoid crest and temporal ridges slightly developed even in adult males; frontal region and posterior part of rostrum less flattened or depressed along the median line, and lacking the concavity in cross section characterizing *planirostris*; ascending branches of premaxillae narrower, less extended posteriorly beyond nasals; palate usually narrower; teeth smaller. Compared with that of *T. p. osgoodi* the skull is more slender in form; rostrum longer and relatively narrower; zygomata more slender, the jugal, especially, more attenuate; palate narrower; auditory bullae less inflated, less bulging below basioccipital; dentition similar. Differing from that of *T. p. dissimilis* in more squarely spreading zygomata; auditory bullae broader, more rounded, less laterally compressed and less projecting below basioccipital; incisors slightly more recurved.

Measurements.—Type: Total length, 230; tail vertebrae, 79; hind foot, 30. Average of three adult male topotypes: 231 (228–234); 77 (74–82); 31 (30–32.5). Two adult female topotypes: 210, 217; 69, 70; 30, 29. *Skull* (type): Condylobasal length, 40; zygomatic breadth, 24.4; greatest breadth across squamosals (over mastoids), 19.5; interorbital constriction, 6.6; length of nasals, 13.7; alveolar length of upper molariform tooth row, 7.3.

Remarks.—T. p. absonus is a fairly well marked form probably restricted to Houserock Valley which occupies a broad depression with a generally level bottom lying along the northern side of the Marble Canyon of the Colorado River. This reach of the river bisects the interior basin of which Houserock Valley is the northern half, at the upper entrance to the Grand Canyon, and forms a barrier limiting the distribution of most of the smaller mammals. The species or subspecies usually differ on the opposing sides of the stream. The bottom of Houserock Valley is gashed by side canyons of the Colorado and the dispersal of this pocket gopher is much restricted even here. It has been found inhabiting soft sand extending for about two miles out over the floor of the valley from near Jacob's Pools, a spring at the western base of the escarpment marking the great fault line known as the Vermilion Cliffs.

Specimens examined.—Twelve, from the type locality.

MAMMALOGY.—Akodon chacoensis, *a new cricetine rodent from Argentina.*[1] H. HAROLD SHAMEL, U. S. National Museum. (Communicated by JOHN B. REESIDE, JR.)

A new cricetine rodent has been found in a collection of mammals from Argentina that was made in 1920 by Dr. Alexander Wetmore. This specimen was discovered at the same time as *Marmosa formosa*, which I described in March, 1930, but until it could be compared with specimens in the British Museum I hesitated to publish on it. It has since been compared with specimens in the British Museum by Dr. W. H. Osgood, and this comparison bears out my original conclusion.

Akodon chacoensis sp. nov.

Figs. 1, 2.

Type.—Adult male, skin and skull, No. 236239, collected in Las Palmas, Chaco, Argentina, by Dr. A. Wetmore, June 20, 1920.

Diagnosis.—In its external measurements it is practically the same size as *Akodon arenicola* from Argentina, but considerably darker in color. Enamel folds, on the inner side of the tooth row, somewhat flattened and folded distinctly backward; reentrant angles closed; without groove on anterior surface of m^1 or inner surface of m^3.

Skull.—The skull, when compared with that of *Akodon arenicola*, is characterized by the large size of the brain case in proportion to the rather weak short rostrum. The anterior edge of the zygomatic plate is perfectly straight and projects forward scarcely at all. The drop downward of the zygoma from the plate is very abrupt, so much so, that the arch formed by the infraorbital plate and the inferior border of the zygoma is almost completely hidden when the skull is viewed from the side. The drop of the zygoma is so abrupt downward that there is rather a well defined angle where it joins the zygomatic plate. The lowest dip of the zygomatic arch is in its center, while in other species it is found at the posterior curve. The rostrum is short. The distance from the anterior edge of zygomatic plate to anterior surface of incisor, 4.6 mm. The lateral depressions of the basioccipital are deep and are scooped out abruptly back of the basal suture. The palate, which extends well behind m^3, is broad at posterior end of the tooth row (4.4 mm.) and not waist-like. Six small pits in the palate, three on each side, but none farther back than a line joining the centers of m^3. The palatal foramen extends from the middle of first molar until it almost touches the incisors.

Teeth.—The enamel folds of the upper molars are more or less flat, and are folded distinctly backward; the reentrant angle on the inner side of the tooth row is directed forward and closed. In other forms of *Akodon* the enamel folds are rounded, not folded backward, and the reentrant angle is open. On the outer side of the tooth row the reentrant angle is directed backward, except the first reentrant angle of m^2 which points straight inward. The teeth are well

[1] Published by permission of the Secretary of the Smithsonian Institution. Received August 8, 1931.

worn; m^1 has three cusps on the outer edge with a secondary one between the second and third, and three on the inner side; m^2 has four cusps on its outer edge, one and three being secondary, two on the inner edge. The anterior surface of m^1 and the inner surface of m^2 are smooth. m^2 is a round peg-like tooth with two well defined enamel islands. The incisors are curved more abruptly inward toward the throat than any other species examined, and according to Thomas are what would be called opisthodont.

Color.—The general color is olivaceous with some buff about the eyes and sides of head and along the sides of the body; but the back is very dark, almost black from the shoulders down to the base of the tail. The underparts are whitish, with a very slight buffish tinge; hairs basally dark slate both above and below. The feet appear to be dark brown clothed in short white hair, but this is because the hairs which cover them are brown at the base and tipped with white. The digits are white.

Measurements.—Type: total length, 160 mm.; tail, 66 mm.; hind foot, 22.5 mm.; greatest length of skull, 25.0 mm.; condylobasal length, 22.4 mm.; zygomatic breadth, 12.2 mm.; interorbital breadth, 4.5 mm.; length of nasals, 8.4 mm.; breadth of braincase, 12.6 mm.; diastema, 5.5 mm.; maxillary tooth row, 4.0 mm.; mandibular tooth row, 4.0 mm.; length of mandible, 14.6 mm.

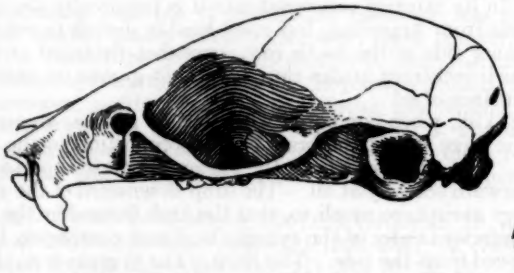


Fig. 1. *Akodon chacoensis*, lateral view of skull × 3. U. S. N. M. No. 236239.

I have compared this specimen with the following species of *Akodon: arenicola, arviculoides, bogotensis, boliviensis, canescens, cursor, lenguarum, mollis, neocenus, pulcherimus, surdus, tolimae.* In only one species of *Akodon* was the brain case any wider and that was in *A. lenguarum* (13.2 mm. as against 12.6 mm.), and *A. lenguarum* is a much larger animal. In all other species the brain case is smaller. Some of the differences between the specimen from Chaco and other species of *Akodon* may be summarized as follows:

1. Much larger brain case in proportion to length of rostrum.
2. Palatal foramen extends nearer the incisors.
3. Palate extends farther behind m^2.
4. Palate behind m^2 not waist-like.
5. Zygomatic plate has a well defined angle.
6. Zygoma drops much lower, particularly anteriorly.

7. Enamel folds on inside of tooth row folded backward on one another like window shutters.

8. Incisors curve inward more abruptly toward the throat.

9. Reentrant angles closed.

This specimen was taken to the British Museum by Dr. W. H. Osgood and compared with South American specimens there. Dr. Osgood had the following to say:

There is nothing like this in the British Museum. The species is doubtless new and the genus is uncertain. . . .

This may be a new genus, but until more than one specimen can be examined, it would not help much to name it. The relationships of those already named are very obscure and Thomas has reversed himself on them several times. There are a lot of species which won't fit exactly into any of the groups he has recognized.

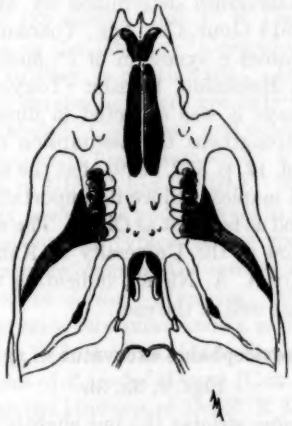


Fig. 2. *Akodon chacoensis*, palatal view of skull × 3. U. S. N. M. No. 236239.

Dr. A. Wetmore at the time he collected this specimen made the following note:

Number 1059 was secured in a small patch of marsh grass, about ten feet square, in an open savannah. The white toes with square cut demarcation behind were especially noticeable. This animal had a skin as tender as a rabbit's, and thus differed from any other mouse that I have handled.

It is doubtless best, under the present condition of uncertainty with respect to some of the South American genera, to make this only a new species. However, the characters of the enamel folds, without considering other peculiarities, are so distinctive that there is no doubt in my mind that when other specimens are taken they will show that this animal represents a new genus.

ENTOMOLOGY.—*New Jassinae, with notes on other species.*[1] P. W. OMAN, U. S. Bureau of Entomology. (Communicated by HAROLD MORRISON.)

PLATYMETOPIUS HYALINUS Osb.

Platymetopius cinctus Mats., Jour. Col. Agr., Tohoku Imperial Univ., Vol. 5, part 7, p. 215, 1914.

This pretty little leafhopper was described by Osborn (Ent. News, XI, p. 501, 1900) from specimens taken in Washington on an introduced maple. He and later workers in the group have strongly suspected that the species was an introduced one, but knowledge of original habitat has not heretofore been available. However, in looking over the leafhoppers in the C. F. Baker collection the writer found two specimens of this insect from Japan labeled *Platymetopius cinctus* Matsumura determined by Matsumura. *P. cinctus* was not described until 1914 (Jour. Col. Agr., Tohoku Imperial Univ., vol. 5, Part 7, p. 215) so it becomes a synonym of *P. hyalinus* Osb. Matsumura reports the species from Hokkaido, Honshu (Tokyo, Gifu, Takasago) and Kiushu (Satsuma) and says it was collected in numbers from a species of maple. This evidence strengthens the assumption of Dikerson and Weiss (Ann. Ent. Soc. Amer. vol. 12, p. 372, 1919) that the hopper was brought into this country on imported maples. Since its importation it has spread rather rapidly and is now reported as far west as Ohio. The writer has also examined specimens in the collection of the University of Kansas taken at Portland, Oregon, Aug. 12, 1920, by A. A. Nichol, indicating the introduction of the species to the west coast as well as the east.

Laevicephalus excavatus n. sp.

Figs. 3, 3a, 3b

Resembling *Laevicephalus striatus* (L) but slightly smaller, with the male plates longer and the last ventral segment of the female roundingly excavated. Length 3–3.5 mm.

Color: Much as in typical *striatus* but variable. Darker specimens show a pair of triangular brown spots at the apex of the vertex and two pairs of quadrangular spots behind these. Paler specimens may have only the spots at the apex. Pronotum with four faint longitudinal brown stripes. Veins of elytra whitish, cells variously embrowned.

Form: Vertex one-fourth wider than long, distinctly right-angled. Head slightly wider than pronotum. General appearance more robust than *striatus*.

Genitalia: Last ventral segment of female slightly longer than preceding with a median U-shaped excavation extending half-way to the base, length next the excavation exceeding length at side of abdomen. Male valve as in *striatus* but plates slightly more exposed and divergent at the tips than in that

[1] Received August 15, 1931.

species. In the internal male genitalia the shaft of the oedagus, from the point of union of the two forks to the point of articulation of the penis, although much heavier and broader, is less than half as long as the corresponding portion in *L. striatus* (L.).

Holotype female from Gazelle, California, Sept. 4, 1897, A. Morse, Collection C. F. Baker (2373).

Allotype male, same data.

Paratypes, 24 males and 5 females with the above data, one male from Siskiyou, Oregon, Sept. 6, 1897, A. Morse, Collection C. F. Baker (2381), and 8 males and 7 females from Lakeside, Lake Tahoe, California, June 29, 1927, J. M. Aldrich.

Types.—Cat. No. 43584, U. S. N. M.

LAEVICEPHALUS DEBILIS (Uhler).

Deltocephalus cadyi Deay, Can. Ent., vol. 59, pp. 54–55, 1927.

Laevicephalus orbiculus DeL. & S. Ann. Ent. Soc. Amer., vol. 22, p. 103, 1929.

In his description of the species (Bul. U. S. Geol. Geog. Surv., 1, p. 360 [94], 1876) Uhler gives, as the locality, "Colorado, on the sides of the high mountains, and near Fair Play, in South Park." Of the original series, so far as the writer is able to determine, there are only two specimens remaining. Both are females, one labeled "Col. Mts." and evidently one of those referred to as occurring "on the sides of high mountains," while the other is from Fair Play. Both labels are in Uhler's handwriting. Since the specimen labeled "Col. Mts." has locality preference and answers in all respects to the description, it should be considered as typical of the species. The example from Fair Play is another species, apparently *exectus* DeLong, and does not fit Uhler's characterization of *debilis*. However, the specimen at hand from "Col. Mts." is not the species heretofore known as *debilis*, but is identical with specimens of *L. orbiculus* DeL. & Slmn. (Ann. Ent. Soc. Amer. vol. 22, p. 103, 1919) and with paratypes of *L. cadyi* (Deay) (Can. Ent., vol. 59, pp. 54–55, 1927), obtained through the kindness of Dr. P. B. Lawson. The above-mentioned species hence must be accepted as synonyms of *L. debilis* (Uhler) while the species commonly known as *debilis* is unnamed and will be described later in this paper.

That Uhler's description does not apply to the larger species formerly known as *debilis* is shown by the fact that he gives the length of 3.5 mm., and says the front is "stained with black above and on each side." These characters fit his example but cannot be applied to the larger species. There are also in the Uhler collection examples of this larger species from the C. F. Baker collection. These Uhler had labeled "*Deltocephalus debilis* Uhler var."—further evidence that he recognized them as not being typical of *debilis*.

L. debilis (Uhl.) seems to be limited in distribution to the higher altitudes in the northwestern part of the United States. I have seen specimens from Wyoming, Colorado, and Montana.

Laevicephalus uhleri n. sp.

Similar to *L. debilis* (Uhler) but larger and more robust, the female genital segment without prominent lateral angles. Length of female 4 mm., of male 3.75 mm.

Color: General ground color yellowish green, front usually brownish with pale arcs over the entire surface. Elytra occasionally black, in part or wholly. Tip of last ventral segment of female black. Abdomen variously infuscated.

Form: Somewhat variable, about as in *debilis* but more robust. Last ventral segment of female with rounding lateral angles, produced medially and slightly bifid. Male valve bluntly triangular, plates large and broad, bluntly rounded and not equaling pygofer.

Most references in literature to *L. debilis* (Uhl.) apply to this species, one of the commonest in high altitude and northern regions. However, this species lacks the prominent lateral angles on the female segment which are characteristic of Uhler's species, and has the front usually wholly uniformly brownish with faint arcs, while *debilis* is marked with black only toward the apex and on the sides of the front, the remaining portion being distinctly lighter.

Holotype female and *allotype* male are from Forrester's Ranch, Laramie Co., Colorado, August 3, 1896, C. F. Baker, Collection C. F. Baker (2020).

Numerous paratypes from Forrester's Ranch, collection C. F. Baker (2020 and 2013) and Morris Ranch, Laramie Co., Colorado, July 11, 1896, C. F. Baker, Collection, C. F. Baker (2009). There are also specimens at hand from other localities in Colorado, Idaho, Montana, Utah, Washington, and Canada.

Types.—Cat. No. 43585, U. S. N. M.

Deltocephalus lineatifrons n. sp.

Figs. 2, 2a, 2b

Size and form of *D. chintinomy* DeLong but with two black longitudinal stripes on the front. Length of male 2.75 mm., of female 3 mm.

Color: General ground color pale yellow. Front and vertex yellow except for two wide parallel stripes of black which cover the sides of the frons and a portion of the genae, and extend to the disc of the vertex, coming closer together as they do so, with a partial break at the apex of the vertex. Pronotum with anterior margin irregularly infuscated, as in the scutellum. Clavus of each elytron with an oblique fuscous mark, the two together forming a rough V on the dorsal median line. A large irregular fuscous spot on the disc and a smaller one near the apex of the corium. Abdomen infuscated. Central portion of hind margin of last ventral segment of female pale brown.

Form: General appearance robust. Vertex well produced and rounded to the front, length on the median line two-thirds the width at base. Pronotum with anterior margin strongly convex, posterior margin straight, length at middle exceeding length of vertex, sides very short. Elytra of male exceeding abdomen; of female, short, leaving tip of abdomen exposed.

Genitalia: Last ventral segment of female twice longer than preceding, lateral angles rounded, central portion rather broadly excavated, a small tooth at the bottom of the excavation. Sides and base of notch brownish. Male valve broad and slightly triangular, plates together broad at base and well produced with rounded tips.

This species belongs to the *fuscinervosus* group but appears to be most

closely related to *chintinomy* DeLong, from which it may be separated by the markings of the vertex and front.

Holotype male and *Allotype* female from Spicer's, North Park, Colorado, July 18, 1896, C. F. Baker, Collection C. F. Baker (2024).

Paratypes.—6 males and 4 females with the above data, 2 males and 2 females from Rabbit Ears Pass, Colorado, July 21, 1896, C. F. Baker, Collection C. F. Baker (2019), and one male from Cameron Pass, N. Colorado, July 30, 1896, C. F. Baker, Collection C. F. Baker (2150).

Types.—Cat. No. 43586, U. S. N. M.

It is interesting to note that North Park, Colorado, has a mean altitude of from 8,000 to 9,000 feet and Rabbit Ears Pass and Cameron Pass are both near 10,000 feet in altitude. C. F. Baker's collection notes state that 2024 was "on grass, *Carex*, and a little *Potentilla*," and 2150 was "on mostly *Carex*." From this it is evident that the species is confined to situations in high altitudes, apparently alpine meadows.

THAMNOTETTIX SIMPLEX (Herrich-Schäeffer).

Deltocephalus chlamydatus Prov., Pet. Faune Ent. Can., vol. 2, p. 339, 1890.

The writer has compared specimens of *Thamnotettix chlamydatus* (Prov.) from Colorado, Canada, and Alaska with examples of *Thamnotettix simplex* (H.S.) from Europe and finds them to be identical in all external characters and in the internal male genitalia. *Th. simplex* (H. S.) has priority.

The species is apparently common in both North America and Europe. In North America it is limited in distribution to northern localities or high altitudes.

DRYLIX TRUNCATUS Sleesman

Fig. 4

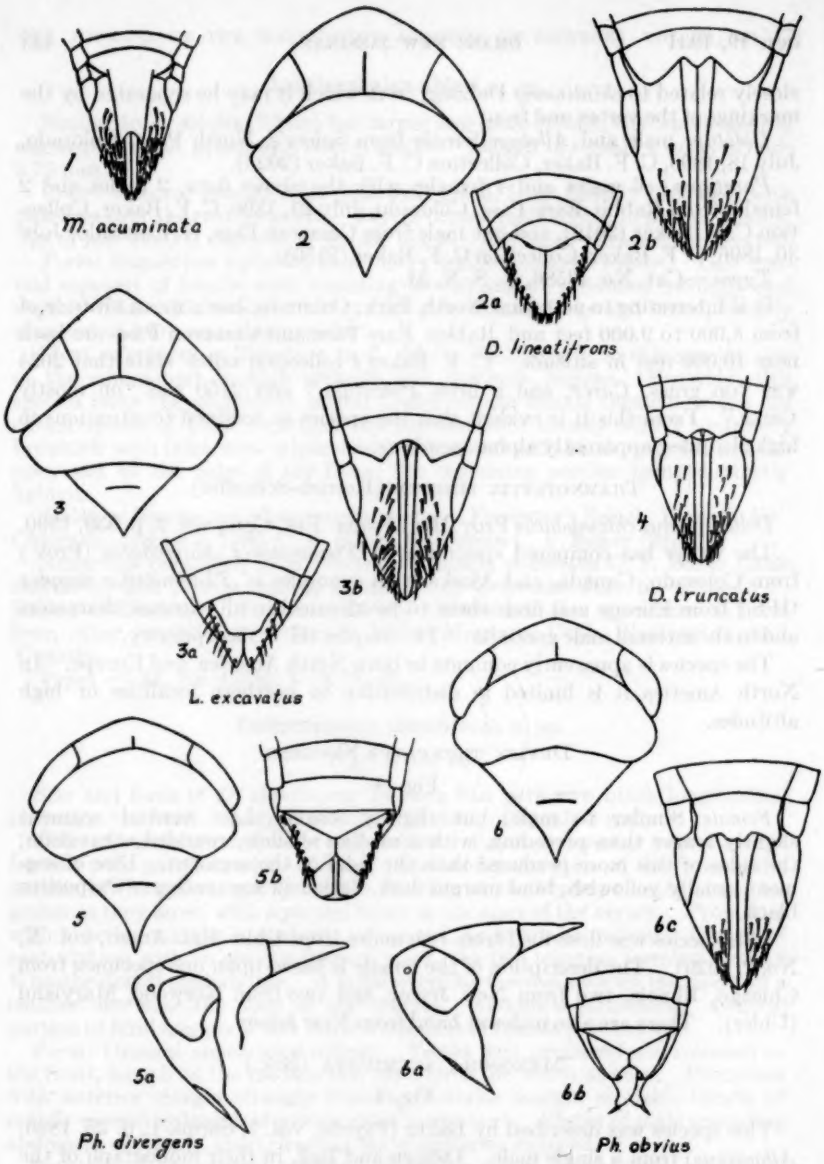
Female: Similar to male, but slightly longer. Last ventral segment slightly longer than preceding, with a median shallow, rounded excavation; the sides of this more produced than the sides of the segment. Disc of segment usually yellowish, hind margin dark, darker in excavation. Ovipositor black.

This species was described from two males from Ohio (Ent. Amer., vol. X, No. 2, 1929). The description of the female is based upon one specimen from Chicago, Illinois, two from New Jersey, and two from Norwood, Maryland (Uhler). There are also males at hand from New Jersey.

MENOSOMA ACUMINATA (Bak.)

Fig. 1

This species was described by Baker (Psyche, vol. 7, Suppl. 1, p. 25, 1896, *Athysanus*) from a single male. Osborn and Ball, in their monograph of the group (1902), stated that "This species is only known by the single, faded, male type and while it without doubt belongs to the subgenus *Conosanus* its character could not be made out with sufficient certainty to warrant including in the synopsis." Sleesman (1929) did not mention it in his monograph of the Euscelis group.



EXPLANATION OF FIGURES

Fig. 1. *Menosoma acuminata;* female genitalia. × 15.5.
Fig. 2. *Deltocephalus lineatifrons;* 2a, male genitalia; 2b, female genitalia. × 31.
Fig. 3. *Laevicephalus excavatus;* 3a, male genitalia; 3b, female genitalia. × 31.
Fig. 4. *Drylix truncatus;* female genitalia. × 15.5.
Fig. 5. *Phlepsius divergens;* 5a, lateral view of head; 5b, male genitalia. × 15.5.
Fig. 6. *Phlepsius obvius;* 6a, lateral view of head; 6b, male genitalia; 6c, female genitalia. × 15.5.

Some time ago there was sent to the Bureau of Entomology by Mr. Van E. Romney from Alamo Alto Sta. in Western Texas a single female which was identified by the writer as *acuminata* (Baker). Subsequently, when the group was being arranged, a pair of specimens was found labeled by Dr. E. D. Ball: "This is *Athysanus acuminatus* Bak." Since these are the only known records of the female of the species a description is here added.

Similar in size and coloration to the male. Last ventral segment with a long, median, spatulate process ending in two lateral points, between these a U-shaped excavation. Segment, aside from process, short, longer next the process than at lateral margins.

The male types seems to be quite typical in color for the species. Ball (Florida Ent., vol. XV, No. 1, p. 5, 1931) has recently placed the species in the genus *Menosoma* Ball.

Phlepsius divergens n. sp.

Figs. 5, 5a, 5b.

Resembling *Phlepsius mimus* Baker in form and coloration but larger, with the vertex shorter and the male plates flat and strongly divergent at the tips. Length of male 6.5 mm.

Color: General ground color creamy to gray. Fuscous irrorations over face and entire dorsal surface without definite pattern. Femora distinctly twice-banded with black. Hind margin of pygofer black.

Form: Vertex short, scarcely longer at middle than next the eye, very slightly angled and not carinate between disc and front. Pronotum over two and one-half times as long as the vertex. Elytra extending well beyond tip of abdomen.

Genitalia: Male valve very short and broad, obtusely angled at the middle. Plates flat and broad, outer margins nearly parallel but slightly concave and converging; inner margins contiguous for a short distance, then sharply diverging, the plates together thus having the appearance of a triangular incision from the hind margin. Pygofer strongly exceeding plates, margins thick and heavy.

Because of the very distinct male genitalia there is no hesitancy in describing this form from a single specimen, the holotype male from Forestburg, Texas, taken in June, 1928.

Type.—Cat. No. 43587, U. S. N. M.

Phlepsius obvius, n. sp.

Figs. 6, 6a, 6b, 6c.

Very similar in size and form to *Phlepsius mimus* Baker but with the elytra much more finely and densely irrorate and the female genital segment broadly produced medially. Length of male 6.25 mm., of female 7 mm.

Color: Dirty white to gray, heavily irrorate with brown. Hind margin of female genital segment dark centrally.

Form: Vertex broad, one-half longer at the middle than next the eye, very bluntly angled and rather rounding to the front. Pronotum nearly twice as long as vertex. Elytra long, tips slightly flaring.

Genitalia: Last ventral segment of female nearly twice as long as preceding, lateral angles well produced and rounded, hind margin shallowly excavated, the median portion with a short, blunt, slightly bifid tooth. Male valve triangular, broad and rather short. Plates short and broad, diverging at tips, somewhat similar to those of *Phlepsius divergens* n. sp. but with the tips thin and curled upward. Pygofer extending beyond plates, tips thin and bluntly pointed.

Holotype male, *Allotype* female, and one female *paratype* from Clyde T. Reed, Kingsville, Texas.

Types.—Cat. No. 43588, U. S. N. M.

BOTANY.—*Two new grasses from Mexico.*[1] JASON R. SWALLEN, Bureau of Plant Industry. (Communicated by A. S. HITCHCOCK.)

Among the grasses collected by Prof. H. H. Bartlett on the Expedition of the University of Michigan to the Sierra de San Carlos, Tamaulipas, Mexico, in the summer of 1930, the following two species are new.

Panicum transiens Swallen, sp. nov.

Perenne; culmi erecti 60–65 cm. alti, pubescentes vel pilosi, ramosi; vaginae papilloso-pilosae, quam internoda culmorum breviores, quam internoda ramorum longiores; laminae 5–12 cm. longae, 6–14 mm. latae, lanceolatae, pubescentes, marginibus albis scabris, basi papilloso-ciliatae; panicula 8–15 cm. longa, ramis adscendentibus vel divergentibus; spiculae appressae, 4 mm. longae, basi attenuatae, papilloso-pubescentes; gluma prima subacuta 2 mm. longa; gluma secunda quam spicula paulo brevior; lemma sterile spiculam aequans; lemma fertile 3 mm. longum, subacutum apice pubescens.

Perennial, culms erect, 60–65 cm. tall, freely branching, pubescent or pilose; sheaths papillose-pilose, densely pubescent on the collar, those of the main culm shorter than the internodes, those of the branches much longer than the internodes; blades 5–12 cm. long, 6–14 mm. wide, lanceolate, flat, pubescent on both surfaces, the white scabrous margins papillose-ciliate toward the rounded base; ligule densely ciliate, about 0.5 mm. long; panicles 8–15 cm. long, the short-branches stiffly ascending or spreading; spikelets (except the terminal ones) short-pediceled, appressed to the branches, 4 mm. long, pointed at the apex, attenuate at the base, papillose-pubescent; first glume 2 mm. long, subacute, the margins somewhat hyaline; second glume a little shorter than the spikelet exposing the fruit; sterile lemma equaling the spikelet; fruit 3 mm. long, subacute, smooth and shining, puberulent at the apex.

Type in the United States National Herbarium No. 1501526, collected on Mesa de Tierra, vicinity of San José, altitude 1000 meters, Sierra de San Carlos, Tamaulipas, Mexico, July 19, 1930, by H. H. Bartlett (No. 10454).

Another specimen (Bartlett 10090) collected at La Vegania, vicinity of San José, Tamaulipas, Mexico, is also referred to this species.

Panicum transiens is allied to *P. pedicellatum* Vasey of Texas and *P. nodatum* Hitchc. & Chase of Texas and northern Tamaulipas. From the

[1] Received August 11, 1931.

former it differs in having longer spikelets, 4 mm. long, from the latter in having a longer subacute first glume, and from both in being a larger plant with much longer and wider blades. These three species compose the Pedicellata group which is intermediate between the subgenus *Dichanthelium* and true *Panicum*.

Eragrostis longiramea Swallen, sp. nov.

Perennis; culmi erecti, 150–160 cm. alti, laeves vel scaberuli; vaginae dense papilloso-pilosae; laminae 35–60 cm. longae, 4–8 mm. latae, planae, elongatae, attenuatae, scabrae, basi angustae et sparsim papilloso-pilosae; panicula 50–60 cm. longa, ramis gracilibus, scabris, adscendentibus vel divergentibus, inferioribus 15–25 cm. longis; spiculae 3–5 mm. longae, 5–7 florae; glumae acutae vel acuminatae, 2 mm. longae, carinis scabris; lemmata 2 mm. longa.

Perennial; culms apparently single, erect, 150–160 cm. tall, smooth or minutely scaberulous; sheaths rounded on the back, shorter or longer than the internodes, densely papillose-pilose with spreading hairs, especially on the collar; blades 35–60 cm. long, 4–8 mm. wide, flat, elongate, attenuate to a fine point, narrowed toward the base, sparsely papillose-pilose on both surfaces near the base, scabrous above and toward the margins beneath, the lower surface otherwise smooth; panicle 50–60 cm. long, the axis glabrous or retrorsely pilose, the branches slender, scabrous, ascending or spreading, pilose in the axils, the lower ones 15–25 cm. long; spikelets 3–5 mm. long, plumbeous, the pedicels long and slender, spreading or sometimes appressed, 5–7 flowered, the florets rather crowded; glumes acute or acuminate, 2 mm. long, scabrous on the keel; lemmas 2 mm. long, slightly keeled toward the minutely scabrous apex, the lateral nerves indistinct.

Type in the United States National Herbarium No. 1501524, collected on Pico del Diablo, vicinity of Marmolejo, Sierra de San Carlos, Tamaulipas, Mexico, August 12, 1930, by H. H. Bartlett (No. 10910).

One other specimen besides the type has been seen. This is Bartlett 10433 collected on Mesa de Tierra, vicinity of San José, Sierra de San Carlos, Tamaulipas, Mexico. This differs from the type in having the axis of the panicle retrorsely pilose.

This species is allied to *E. lugens* Nees and *E. polytricha* Hack., differing from them in being a much larger plant with broader, elongate blades.

BOTANY.—*The juice sac of the orange with some observations on the plastids of citrus.*[1] M. B. MATLACK, U. S. Department of Agriculture. (Communicated by J. A. LECLERC.)

The writer became interested in the structure of the juice sac of the orange when he observed that only a small part of the liquid contained therein ran out when the juice sac was pricked with a needle. He also noted what appeared to be a cellular structure in the inner portion of the juice sac when it was flattened out on a slide and observed under a microscope. This led him to make some sections of the sacs. The

[1] Food Research Division Contribution No. 104. Published by permission of the Chief of the Bureau of Chemistry and Soils. Received August 1, 1931.

only sections of which the writer is aware are those of Tschirch and Oesterle.[2] These investigators show only sketches of the cross section of the juice sacs of mature and immature bitter oranges.

The juice sacs were fixed in Carnoy's fluid and embedded in paraffine by the usual method. The process had to be carried on very gradually in order to prevent collapse of the material. The sections were cut 20 microns thick by means of a rotary microtome. Bismark brown was used as a staining agent. Haemotoxylin stains the sections well but makes the material more difficult to photograph. The walls of the juice sac are very thin and take up little of the stain, consequently they transmit too much light. However, by using the brown stain and blue light fairly satisfactory photographs were obtained. Exposures of one hour and twenty minutes were used. Figure 1 shows a cross section and Figure 2 a longitudinal section. Owing to the delicacy of the material it was impossible to obtain a section which was entirely perfect. From the standpoint of edibility this very tenderness is of great importance.

While working on the juice sac it was noted that they contained numerous plastids. These cannot be shown in this type of section since they are removed by the fixing and mounting operations. By teasing out the inside portion of the fresh juice sac these plastids can easily be observed under the microscope. Their size and shape appear to be characteristic of the species from which they are obtained, which fact might be of use in genetical studies. For instance the tangerine, satsuma, and willow-leaved mandarin oranges have spindle-shaped plastids. The grapefruit has what appears to be elaioplasts or colorless groups of oil-like droplets. The Sampson tangelo has a red meat like the tangerine, and the chromoplasts are numerous and spindle shaped. The Thornton tangelo has a yellow meat with a slight orange tint, colorless globules, as in the grapefruit, and small orange isodiametric plastids. Lastly the Nocatee tangelo has only the colorless globules or elaioplasts, and the general appearance of the meat is the same as that of the grapefruit. It is thought by some botanists that the king orange does not belong to the same species as the mandarin. Observations disclose that, as noted above in the tangerine, satsuma, and willow-leaved mandarin the chromoplasts are spindle-shaped, whereas in the king orange they are isodiametric.

[2] Anatomischer atlas der Pharmakognosie und Nahrungsmittelkunde, 1900. Tab. 69 and 70. Fig. 44 and 45.

In general the plastids of citrus fruits can be divided into three groups. The first includes isodiametric plastids as found in the king

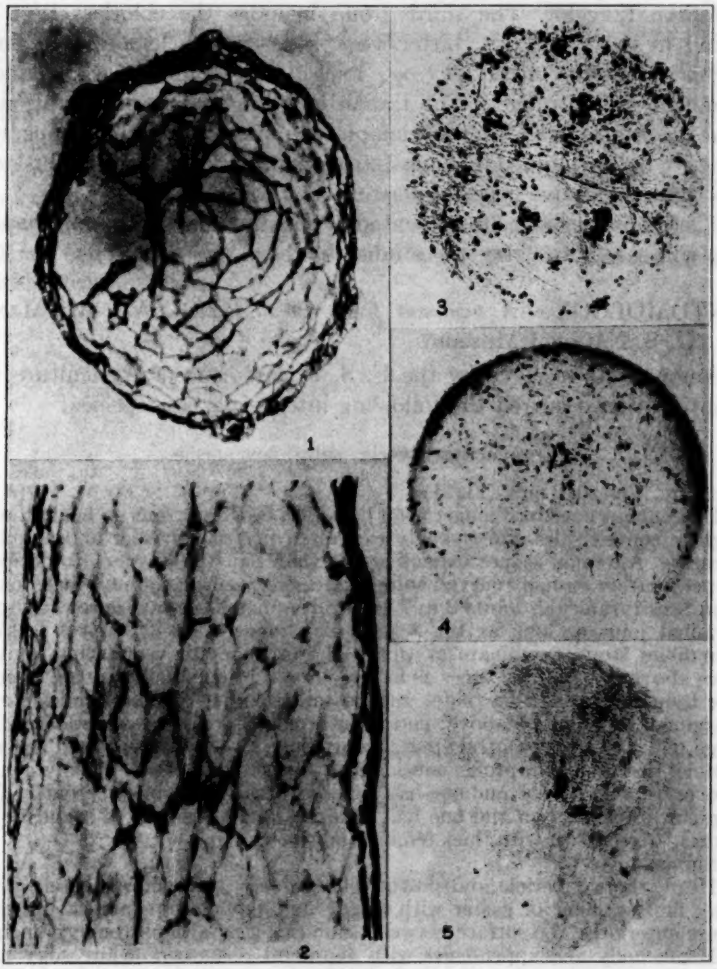


Figure 1.—Juice sac. X Section × 80.
Figure 2.—Juice sac. L Section × 80,
Figure 3.—King orange. Chromoplasts × 440.
Figure 4.—Satsuma orange. Chromoplasts × 440.
Figure 5.—Grapefruit. Elaioplasts ? × 440.

orange, three varieties of kumquats and the numerous varieties of the sweet orange. In the second are the spindle-shaped plastids of the satsuma, tangerine, mandarin, calamondin, rangpur lime, and the Sampson tangelo. The third group includes the colorless type as found in the grapefruit, bittersweet, sour orange, lemon, acid lime, *Citrus trifoliata*, citron (Etrog, Parish and commercial), Siamese pummelo and citrange. The Indian Red Pummelo is an exception in that it contains in addition to elaioplasts, pink crystals which appear at times to be surrounded by a pink stroma. Figures 3, 4 and 5 illustrate the three respective types of plastids.

These observations are presented at this time in the hope that some one will see fit to carry the studies further.

ENTOMOLOGY.—*A new ant from Porto Rico.*[1] WM. M. MANN, U. S. National Museum.

Among ants received by the U. S. Department of Agriculture for identification occurred the following interesting new species:

Cerapachys (Syscia) seini, new species.

Worker. Length 2 mm. (Fig. 1).

Head about one-third longer than broad, as broad in front as behind, with slightly convex sides and strongly excavated posterior border and angulate corners. Antennal scapes extending less than half the distance to occipital corners; rather strongly curved and clavate; first funicular joint a little longer than broad; funicular joints 2 to 7 transverse, increasing in size toward apex; terminal joint as long as the 3 preceding joints together. Eyes lacking. Mandibles stout, acuminate at tips. Thorax in profile very feebly convex, from above nearly three times as long as broad; promesonotal suture discernible though very shallow; sides and posterior border of epinotum narrowly margined, subangulate above; petiole in profile as long as postpetiole with a large and flat anteroventral spine; from above two-thirds as broad as postpetiole; postpetiole in profile considerably deeper than petiole, feebly convex above; from above one and one-half times as broad behind as in front. First segment of gaster two and one half times as long as remaining segments together. Legs short with thick femora and tibiae.

Subopaque.

Head, thorax, petiole and postpetiole coarsely, somewhat rugosely punctate; first segment of gaster with large shallow punctures largest and most dense anteriorly; the surface between sublucid; legs rather strongly punctate.

Head, body and appendages with abundant recumbent white silky hairs and a few longer and coarser sub-erect hairs.

Color light yellowish brown.

Type: Cat. No. 43648 U. S. N. M.

Type locality: Porto Rico Insular Experiment Station, Rio Piedras, P. R.

[1] Received August 15, 1931.

This species is described from a series collected by Francisco Sein in soil about the roots of sugar cane.

Although the type locality of this species is Porto Rico and it is the first record of an ant of this subgenus in the New World, I believe it very probable that it is endemic to New Guinea and has been introduced into Porto Rico in soil with sugar cane. The other species of *Syscia* occur in Australia, Malaya and Ceylon, with the exception of *silvestrii* Wheeler, which was described from Hawaii. I think it possible that the latter species also will later be found endemic to New Guinea.

C. seini is one of the smallest of the species; the promesonotal suture is more distinct than in the other known forms and the punctation of the gaster finer and shallower with the area between smooth instead of rugulose. *C. silvestrii* is larger and has the head larger in proportion to its width and the antennal scapes longer, stouter and less curved.

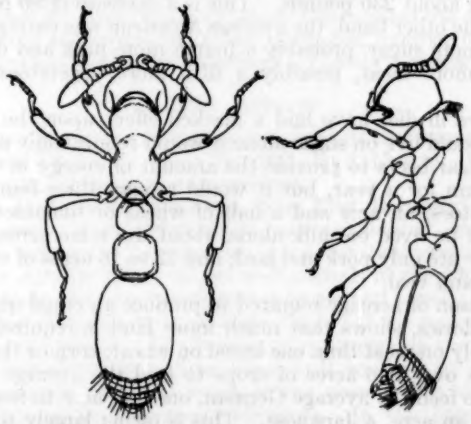


Fig. 1. *Cerapachys (Syscia) seini*, n. sp., worker. Drawn by ELEANOR A. CARLIN.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

THE ACADEMY

239TH MEETING

The 239th meeting of the ACADEMY was held in the Assembly Hall of the Cosmos Club on Thursday, March 19, 1931, Vice-President CURTIS presiding. About 200 persons were present.

Program: JOHN C. MERRIAM, President of the Carnegie Institution of Washington: *The unity of nature as illustrated by the Grand Canyon.*—The speaker described the educational features provided at the Grand Canyon for the purpose of assisting visitors in a critical study of the formation and structure of the canyon walls.

240TH MEETING

The 240th meeting of the ACADEMY was held in the Assembly Hall of the Cosmos Club on Thursday, April 16, 1931, Vice-President CURTIS presiding.

Program: O. E. BAKER, Bureau of Agricultural Economics, U. S. Department of Agriculture: *Changes in diet affect agriculture.*—The economic depression during 1930 resulted in a downward trend in the consumption of several foods by the American people toward the standards that prevailed during the war years and the years immediately preceding.

The World War caused changes in the diet of the American people. The principal change after the war was a notable decline in the use of bread, of corn meal, and other cereal foods and an increase in the consumption of milk, of meat, of sugar, of fresh vegetables, and of fruit. Apparently the higher wages and salaries of city people since the war has enabled them to eat more of the expensive foods.

During the five war years, 1914 to 1918, the average consumption per person of wheat, corn, oats, rye, buckwheat and barley for human food totaled about 310 pounds a year, whereas during the last five years 1924–1928 it was only about 230 pounds. This is a decrease of 80 pounds, or over a fourth. On the other hand, the average American was eating until recently nearly a third more sugar, probably a fourth more milk and dairy products, nearly a fifth more meat, possibly a fifth more vegetables, and a tenth more fruit.

These changes in diet have had a marked effect upon the need for farm land. If man could live on sugar alone it would require only about one-third of an acre of sugar beets to provide the amount of energy in the food of the average American for a year, but it would require three-fourths of an acre of corn or potatoes, an acre and a half of wheat or tomatoes, two to three acres of crops if he lived on milk alone, about the same acreage of corn and other crops if he ate only pork and lard, and 12 to 16 acres of crops if he lived wholly on beef and veal.

This comparison of acreage required to produce an equal quantity of food, measured in calories, shows that much more land is required to produce a diet based largely on meat than one based on wheat, corn or the other cereals. It now requires over two acres of crops to feed the average American, but only one acre to feed the average German, one-half acre to feed a Chinaman, and one-fourth an acre, a Japanese. This is owing largely to the difference in diet, except that the difference between China and Japan is owing to much higher crop yields in Japan.

The decrease in the United States since the war years in consumption per person of cereal foods, principally wheat flour and corn meal, has reduced the area of these crops needed to feed a person by about one-twelfth of an acre; while the increase in consumption of milk, vegetables, fruits, and of meat prior to 1929 increased the area per person needed to produce these products by a quarter of an acre. Nearly all the increase in sugar consumption has come from Cuba, Porto Rico, Hawaii and the Philippines, so it has not been included in the estimate. The net result, therefore, of this change in diet was an increase in crop land needed to feed each person of about one-sixth of an acre. Meanwhile, the population of the United States increased from 95 million to 120 million, which, after allowing for the change in diet, indicates that about 50 million acres more crop land would be needed to feed our people than during the war, provided no changes occurred in

production per acre. But the fact is that there are only about 6 million more acres of crops used to produce the nation's food than were used during the war. What has produced this result?

First, the use of the automobile and the tractor has reduced the number of horses and mules in the United States by over seven million and released for other uses probably 20 to 25 million acres of crop land formerly used to feed these horses and mules that have disappeared. Most of this land thus released is used to feed meat and milk animals.

Secondly, there has been a great improvement in the amount of meat and milk produced per unit of feed consumed.

Thirdly, there has been a shift from the less productive classes of animals per unit of feed consumed to the more productive classes,—notably from beef cattle to dairy cattle and hogs.

Fourthly, there has been a shift from the less productive crops to the more productive.

Fifthly, there has been a little increase in the yield per acre of many of the crops.

In brief, the application of science to agriculture, which has taken place more rapidly since the War than ever before, has enabled the American farmer to provide a more expensive diet to an increasing number of people from a practically stationary acreage of crop land. (*Author's abstract.*)

241ST MEETING

The 241st meeting of the ACADEMY was held in the Assembly Hall of the Cosmos Club on Thursday, May 21, 1931, at 8:15 p.m., President COBB presiding. About 125 persons were present.

Program: E. D. MERRILL, Director, New York Botanical Garden: *Plants and animals of the Philippines and neighboring islands—How they came to be where they are.*—Introductory to a general discussion of the present-day geographic distribution of plants and animals in the Philippines and in neighboring islands, the speaker discussed in general terms the relative sizes of the geographic areas involved, geologic history of the region, hydrography, climate, wind, and rainfall. The bearing of endemism on the general subject was stressed, indicating that those areas still covered by primary forests were most important, and that much of the present-day vegetation in the settled areas represents introduced elements. In the plant kingdom the percentage of endemism in the primary forest exceeds 80 per cent while in the settled areas and secondary forests it scarcely exceeds 10 per cent.

Attention was called to the fact that man has been a most important disturbing factor in reference to the distribution of both plants and animals in Malaysia. In drawing conclusions as to biogeographic relationships, emphasis was placed on the importance of assembling data covering all groups of plants and animals, for the reason that distributional data appertaining to one group frequently shows entirely different biogeographic relationships as compared with other groups. As an illustration, if one studies the Dipterocarpaceae, one would conclude that the Philippine flora was dominently western Malaysian in origin, but if one studied the Myrtaceae, one would conclude that it was dominently Australian. For purposes of discussion three areas were indicated; western Malaysia or Sundaland (Borneo, Sumatra, Java, etc.); eastern Malaysia or Papualand (New Guiana and adjacent islands); and Wallacea, the region between Wallace's and Weber's lines separating Sundaland from Papualand. Data were presented

covering the present known geographic distribution of various groups of insects, fresh-water and land molluscs, fresh-water fishes, batrachians, reptiles, birds, mammals, and plants. In general there is a close correlation in the present distribution in all of these groups as between the Philippines and both eastern and western Malaysia or Papualand and Sundaland. Asiatic types are found to diminish rapidly in numbers and in importance as one proceeds eastward, and Australian types similarly decrease as one proceeds westward and northward in Malaysia. The apparently anomalous distribution of plants and animals in Malaysia and the Philippines, with much stronger Australian elements in the Philippines than in Java and the other Sunda Islands, was explained by the probable existence during Pleistocene and Pliocene times of two more or less stable continental areas represented by the two great continental shelves as delimited by the present 200-meter line. To the west the Sunda Islands (Java, Sumatra, and Borneo, including the Palawan-Calamian group in the Philippines) were at times connected with Asia, and New Guiana had the same history with relation to Australia.

Between these two stable areas there was apparently an unstable constantly archipelagic area which has existed since Tertiary times, the practical absence of mammals in Australia indicating no direct connections between Asia and Australia since the mammals attained dominance as a group. This insular area has inhibited direct east and west intermigration of both plants and animals in Malaysia as a whole. This area, called "Wallacea," is approximately delimited on the west by Wallace's line and on the east by Weber's line. These two "lines," originally proposed as delimiting or separating the Asiatic and Australian faunas, are approximately the eastern boundary of Sundaland and the western boundary of Papualand, where the two old continental areas impinge on the intermediate unstable insular area. Wallacea includes all of the Philippines (except the Palawan-Calamian group), Celebes, Moluccas, Lesser Sunda Islands and Gilolo.

The two stable areas, Sundaland and Papualand, are characterized by the presence of vast continental shelves with a very even submarine topography, the water averaging less than 100 meters in depth in these great shelf seas. In contrast to this, Wallacea has an entirely different submarine topography, being characterized by the presence of numerous great deeps, with depths as great as 5000 to 6000 meters, these deeps being more or less parallel to the rows of raised islands as pointed out by Molengraff. Intermigration has apparently been in general north and south within Wallacea rather than east and west across it. Thus many Australian types were able to reach far to the north in the Philippines, but few were able to reach western Malaysia, although Java is much closer to Australia than is the Philippine group. There was apparently a similar north and south migration of both eastern and western Malaysian types via the Philippines, and some from each area succeeded in negotiating the two longer sides of this hypothetical triangle rather than east and west across its comparatively narrow base, which is represented by the Lesser Sunda Islands.

In closing, the speaker discussed Dr. Lam's application of Wegener's theory of continental shift to the genetic phytogeography of the Malay Archipelago. According to this theory the Australian region shifted northward, coming into collision with the Asiatic continent in the Pleistocene. After the collision the two continents commenced exchanging plants and animals. Dr. Lam considers that the theory of an intermediate unstable

insular area of long geologic duration is unsatisfactory in that it gives no real explanation of the principal problem involved; that is why two regions having such remarkably different floras and faunas as Australia and Asia lie so close together in present geography. (*Author's abstract.*)

CHARLES THOM, *Recording Secretary.*

BIOLOGICAL SOCIETY

757TH MEETING

The 757th meeting was held in the New Assembly Hall of the Cosmos Club January 24, 1931 at 8:10 p.m., with President WETMORE in the chair and 130 persons present. New member elected: EDMUND MCNALLY.

A. A. DOOLITTLE exhibited two hermetically sealed jars containing growing algae and mosses, which had been sealed in 1924.

E. P. WALKER reported four nests with eggs of black-crowned night herons in the large open flight cage at the Zoological Park.

Program: A. H. HOWELL: *Exhibition of paintings of Florida birds.*—The speaker showed a number of water-color and oil paintings by F. L. JAQUES of the American Museum of Natural History, which will be used to illustrate his forthcoming book on the birds of Florida.

VERNON BAILEY: *General features of the Upper Mississippi River Wild Life and Fish Refuge.*—The Upper Mississippi River Wild Life and Fish Refuge, including the island flood lands and waters of the Mississippi River Valley from Lake Pepin, in southern Minnesota, to near Rock Island, Illinois, about 300 miles of irregular, scattered, and broken areas of land and water, was set aside by Congress for a great experiment in conservation and wild life study. Money was appropriated for purchase of the cheaper bottom lands not suitable for agriculture but well adapted to game and native wild life. Up to date about half of the land needed for the refuge has been secured, enough to start some experiments in restocking and building up the native fauna. The general plan is to keep many extensive areas as absolute sanctuaries, enough to maintain abundance of native life for the whole region, but outside of these areas to allow enough hunting and trapping to remove the excess of each species so they will not overpopulate and destroy their supply of food and cover. The refuge is on one of the greatest migratory highways of waterfowl in the country.

To study the present condition of its native life Mr. and Mrs. BAILEY spent the summer of 1930 at various points along the length of the refuge. Mr. BAILEY grew up in the Upper Mississippi Valley, so its general life has been familiar to him for many years. He saw it first from a covered wagon in 1869, but this part of the valley was a well settled country then and his father had to go 30 miles north of Minneapolis before finding a homestead of choice land. The changes in bird and animal life and the possibilities of the region as a sanctuary were described. (*Author's abstract.*)

F. M. UHLER: *Waterfowl and reptile life of the Upper Mississippi River Wild Life and Fish Refuge.*—The Bureau of Biological Survey conducted preliminary biological investigations in the Upper Mississippi River Wild Life Refuge during the summers of 1926, 1927, and 1928. Two biologists worked together from a headquarters boat each year. The principal purpose was to determine the type, abundance, and distribution of waterfowl foods, and factors affecting their development throughout the Refuge. Fluctuating water levels were found to be the most important single factor in retarding the development of waterfowl foods.

During the course of this work about 400 species of plants (principally aquatic and moist-soil types) were studied. Notes on the water-fowl indicate that the once rare wood duck is now the most abundant of 14 species of ducks recorded in the Refuge during the nesting season; 41 species and races of reptiles and amphibians have been recorded from the counties which the refuge traverses; 90 species and races of fishes and 1 lamprey have been taken in the refuge, and 27 additional fishes and 1 more lamprey have been recorded in adjacent tributary streams. Sixty kinds of mussels and five species of crayfishes have been recorded from this area.

The Refuge will probably be greatly altered in the near future by the construction of a series of dams to facilitate navigation in the Upper Mississippi River. The final effects of that program are problematic. (*Author's abstract.*)

758TH MEETING

The 758th meeting was held in the New Assembly Hall of the Cosmos Club February 7, 1931 at 8:15 p.m., with President WETMORE in the chair and 96 persons present. New members elected: H. C. BRYANT, THEODORE KOPPANYI, W. C. MANSFIELD.

W. B. BELL reported that the musk oxen recently introduced into Alaska were adapting themselves readily to the new environment and gaining in weight.

A. WETMORE announced that it was planned to open the new reptile house at the National Zoological Park on February 28.

Program: T. GILBERT PEARSON: *Adventures in bird protection.*—The speaker gave his first public address on the subject of bird protection just 27 years ago in Washington, D. C. From this point the history of bird protection here and abroad was sketched.

In Europe bird protection usually means the protection of game on large estates. The first known organization to take up bird protection was in France and was for the purpose of controlling wolves. It dates back to the time of Charlemagne.

The present International Committee on Bird Protection has on its agenda consideration of such problems as the protection of song birds, oil pollution, sizes of "leads" to be used in shooting, and others. Game birds are frequently abundant on estates but the protection of song birds usually is a county matter, the protected species being listed on schedules, and one given protection in one county may not receive it in another. In Scotland no public shooting is permitted except between tides. England has a Royal Society for the Protection of Birds, with volunteer "watchers" who accumulate much useful information. France also has a Society for Bird Protection and last year the speaker attended the celebration at the establishment of their 1000th sanctuary. These are nothing more than plots of land privately owned where the owner agrees to protect the birds. Hawks are very scarce in Europe, being killed at every opportunity. Small song birds are not accorded legal protection, and in one year in Belgium, according to official figures, between three and four million were killed for food.

Referring to American efforts at wild life protection, the speaker gave first the history of Pelican Island, Florida, established by order of President Roosevelt in 1904. Pelicans have at times suffered heavily both at the hands of nature and man. During the war their destruction was urged as a conservation measure but an investigation showed that their food was almost 100 per cent menhaden, fish of no value as human food.

The speaker also dealt with the efforts to establish a national park in the Everglades, the efforts to preserve the Heath Hen on Martha's Vineyard, Massachusetts, and the success achieved in establishing the Paul J. Rainey Wild Life Sanctuary in Louisiana and the Antelope Refuge in Nevada.

H. W. TERHUNE: *Wild life protection in Alaska.*—The Alaska Game Commission is badly hampered through lack of wardens and operating funds. During its five years' operations, the revenues from sale of licenses, fines and forfeitures have increased from $19,000 in the fiscal year 1926, to $53,000 in 1930, while funds appropriated for the work have increased from $55,000 in 1926 to $97,000 in 1930. Starting with a force of 5 field wardens the Commission now has 10, 3 having been added during the present year. In addition to this force of regularly appointed full time men, there are about 90 licensed guides who are ex-officio wardens. The enforcement work of the guides, however, is largely preventative, as they are not authorized to incur expenses chargeable to the enforcement appropriation. Seven wardens with a district of over 90,000 square miles each, during the fiscal year 1930, travelled 55,000 miles in the course of enforcement. The Alaska Game Commission is encouraged in the work by the Courts meting jail sentences in addition to heavy fines in nearly fifty per cent of convictions.

Game conditions, generally, are improving. Since 1915 game has increased in nearly every section of the territory. There are no grounds for the present hysteria over the depletion of the large brown bears of Alaska, as they also are increasing. Some apprehension is felt, however, regarding the mountain sheep, in whose range the coyotes are rapidly advancing. Increasing reports of the scattering of some of the herds of sheep by coyotes are viewed with alarm. Incidentally, recent reports state that two coyotes were taken in the winter of 1929–30 near Point Barrow, the top of the continent.

Furs constitute one of the principal resources of Alaska, standing fourth in exports. Fur exports for 1929, amounting to 4½ millions, were exceeded only by fisheries products with 46½ millions, copper 8½ millions, gold 7 millions. A study of the records of furs shipped from Alaska during the past 18 years indicates a well defined cycle of plenty and scarcity. (*Author's abstract.*)

759TH MEETING

The 759th meeting was held in the auditorium of the New National Museum February 28, 1931 at 8:10 p.m., with Vice-President JACKSON in the chair and 280 persons present.

Program: R. L. DITMARS: *Motion picture studies of reptiles* (illustrated)—The speaker sketched the advances in the last thirty years in the classification of snakes and in the treatment of snake poisoning. He then showed three reels of excellent moving pictures taken at the New York Zoological Park, illustrating (1) tortoises and lizards; (2) harmless snakes; and (3) poisonous lizards and snakes, accompanying the pictures with a running account of the animals' habits.

760TH MEETING

The 760th meeting was held in the New Assembly Hall of the Cosmos Club March 7, 1931 at 8:10 p.m., with President WETMORE in the chair and 90 persons present.

FRANK THONE exhibited several recently published books on biological subjects including SKENE'S *School botany*, WHEELER'S *Demons of the dust*, HORNADAY'S *Thirty years' war for wild life*, KUDO'S *Handbook of protozoology*, and FUERTES' *Abyssinian birds and mammals*.

W. M. MANN stated that the newly-opened reptile house has been visited by a large number of people.

E. P. WALKER mentioned a recent shipment of Canada geese, white-tailed deer, and three fine buck antelope, received from the Biological Survey.

Program: C. H. TOWNSEND: *A recent expedition to the Galapagos Islands and studies of Galapagos tortoises.*—The speaker has been interested for several years in an attempt to save from extermination the tortoises of the Galapagos Islands. For many years these tortoises furnished food to whalers, as well as to many other vessels. Examination of log books of whalers at New Bedford indicates that Baur's estimate that ten million tortoises were taken from the islands is very likely not too large. Tortoises were practically gone from the accessible islands by the last quarter of the last century. They were also harried by hunters from Ecuador who killed them for the oil. In 1928 a vessel of the Bureau of Fisheries, acting with funds furnished by the New York Zoological Society, visited the Galapagos Islands to secure tortoises for zoological gardens. On Duncan Island none were found, but on Albemarle they were still found in numbers. Altogether 180 specimens were brought back, some of which were kept at New York while others were widely distributed to zoological gardens in the southern tier of States and in Bermuda, Honolulu, and Australia. No specimens weighing more than 80 pounds were brought back owing to difficult conditions of transport on the islands, and most of them were very much smaller. In general, it was found that in captivity they doubled or more than doubled their weight in two years. A specimen kept by the speaker at his home would go every evening to a corner of the yard next to a fence or log, scratch off the grass, and lie down on the raw earth. This practice was no doubt safe in its natural home, but was not so in the much cooler climate of New York. Consequently every evening for two weeks the turtle was driven into the garage where he burrowed into a pile of straw. At the end of that time he learned to do this for himself. In 1930 the speaker, with other naturalists, accompanied Vincent Astor on an expedition to the Galapagos Islands on which other specimens were collected. Photographs of the tortoises in the wild state and in captivity were shown, and moving picture films taken on the Vincent Astor Expedition.

761ST MEETING

The 761st meeting was held in the New Assembly Hall of the Cosmos Club March 21, 1931 at 8:15 p.m., with Vice-President JACKSON in the chair and 63 persons present.

C. W. STILES gave a brief resumé of the results of a 5000-mile trip through the southern States in search of hookworm. Newspaper reports that hookworm has been eradicated in the United States are incorrect. The pupils of 97 schools in seven States were examined. Infection varying from 1.4 per cent to 98 per cent was found, with an average of 32 per cent. Deplorable conditions of poverty and destitution were met in many places.

F. THONE exhibited several recent publications: P. EIPPER'S *Animals looking at you* and *Animal children*, and W. S. BRONSON'S *Fingerfins* and *Paddlewings*, the two latter, describing the life of a sargassum fish and the Galapagos penguin respectively, being written for children.

Program: ELIE CHEVERLANGE: *Exhibition of paintings of fishes of Tahiti.*—The speaker exhibited a series of colored paintings he had recently made and described his method of work. As far as possible, the fish were caught and kept alive in aquaria in order to observe their natural colors, which in many cases change greatly after death. He also studied them under water and made sketches there. By taking in his mouth a tube two or three fathoms long, supported by a float, through which he breathed, and with a clothespin on his nose, he found it possible to stay under water for half an hour without ill effects.

D. E. BUCKINGHAM: *The fish poison Derris.—Derris elliptica* is one of the several varieties of poisonous plants employed by the natives of the Malaysian Archipelago as a fish poison. The root of the plant is bruised and thrown into a stream where fish abound; within a few minutes, the fish are stimulated and swim in a frightened manner; then they appear on the surface either stunned or apparently dead. This method of fishing is illegal but is carried on secretly with success.

In other tropical countries, including South and Central America, the plant Cube (*Lonchocarous nicou*), as well as many other plants, produces this poisonous effect on fish. The active principle of Derris and Cube is rotenone, a white crystalline compound, having the formula $C_{22}H_{22}O_6$. It is insoluble in water, but soluble in acetone, chloroform, and many other organic solvents. Rotenone is extremely toxic to fish, one part in twenty million parts water killing gold fish in three hours; it is also highly toxic to insects and is effective both as a contact and as a stomach insecticide.

Derris extract has been used as an arrow poison by the head hunters of Borneo and the Amazon River. Because of its reputation as a poison used by uncivilized tribes, the writer has made many experiments to determine its effect on domestic animals when administered by the mouth.

The usefulness of rotenone as well as the extract of Derris as an insecticide would be seriously curtailed if it were markedly toxic to warm blooded animals; if, for instance, its action were similar to that of curare, strychnine, or similar drugs. The ideal insecticide is one that is toxic to insects but harmless to domestic animals.

Both rotenone and Derris extract have been proved, conclusively, to be non-poisonous to all domestic animals in any reasonable dose. Remarkable effects have been noted when Derris extract, in three per cent dilution in talcum, is applied as an insecticide on dogs and cats for fleas, lice, and ticks. Rotenone and Derris extract are proved to be valuable new insecticides, in both agriculture and veterinary medicine.

There is a large annual production of cultivated crops of Derris in Sumatra and the Malay States. The roots mature full toxicity in twenty months. An American market is sure to follow the fine results obtained with rotenone as well as the toxic extract of Derris. (*Author's abstract.*)

R. E. TARBETT: *Control over mosquito breeding.*—Different species of mosquitoes differ greatly in habits, on which methods of control must be based. The fundamental point is the elimination of water, the breeding place, as far as possible, and the control of the remainder with oil. For the author's purpose, mosquitoes are divided into four groups—malarial, domestic, woodland, and temporary pool species. Of three species of *Anopheles* in the southeastern states only *A. quadrimaculatus* is important. It breeds only in quiet waters, feeds only after dark, has a flight range of about a mile, and appears to have a homing instinct in connection with egg laying. Like some

other species, it will enter a house through the chimney but can be kept out by hanging up a bag of naphthalene balls. The larvae feed on the surface of water and can be killed by a light dust of paris green (1 pound per acre). The principal domestic mosquitoes are *Culex* sp. and in the South *Aedes aegypti*. The former breed in any foul water, even in underground water containers which may be difficult to find or to reach; the latter only in man-made utensils in or around inhabited dwellings. The woodland species breed in open water and their habits vary greatly. The species breeding only in temporary pools lay their eggs in depressions where they remain dormant until rain. Development takes only a few days. Control measures in a given area usually do not extend far enough to reach the species of this group. In conclusion the speaker showed a film illustrating the life cycle of *Aedes aegypti*.

762ND MEETING

The 762nd meeting was held in the New Assembly Hall of the Cosmos Club April 4, 1931 at 8:10 p.m., with Vice-President JACKSON in the chair and 42 persons present.

J. M. ALDRICH stated that during a trip in the West last summer he found that in one locality bluebirds were nesting in about one-half the drop-front mail boxes.

Program: H. S. DAVIS: *Progress in experimental fish culture.*—In this country fish culture has been confined to the propagation of game fish and goldfish. At present emphasis is laid on the planting of older fish than formerly, in proper situations, and on making lakes more productive. Trout are grown for market in large numbers, and other fish may be later. There is an experimental station devoted to trout in Vermont, one devoted to pond culture in Iowa, and another in West Virginia devoted to both. Pictures were exhibited showing hatcheries and also work in the sloughs in the Upper Mississippi Refuge.

Discussed by E. P. WALKER.

C. R. LUCAS: *Commercial fish farming in the United States.*—There are over 1,000 nurseries and hatcheries in the United States, 455 of which are governmental. The value of their product is over $2,000,000 annually. The first hatchery for trout was established in 1864, and there are now over 100 establishments; that for goldfish shortly after 1878 (now 44 establishments); that for pond fish in 1929 (now 11).

H. B. HUMPHREY: *The relation of trees and other vegetation to stream flow.*—The speaker presented the results of observations on the rate of discharge of a small stream near his home at Cabin John, Maryland, made last autumn and subsequently. These observations show that there was an immediate relationship between sunlight and stream discharge, and that after the trees and other vegetation lost their foliage the discharge increased greatly. During 36 hours of continuous observation on 27–29 September, it was found that vegetation exerted an increasing pull on the water supply from about 10 a.m. until late afternoon, and that no water was running from about 3 p.m. to 7 p.m. (Full report in Monthly Weather Review **58**: 397–398. 1930.)

In discussion, R. M. LIBBEY stated that owing to the small amount of fresh water in the Potomac, crabs had been common last summer nearly up to Alexandria.

763RD MEETING

The 763rd meeting was held in the New Assembly Hall of the Cosmos Club April 18, 1931 at 8:10 p.m., with Vice-President STILES in the chair and 75 persons present. New member elected: LOUISE W. COCKE.

Program: W. A. HOFFMAN: *A consideration of educational, especially biological, progress in China, prefaced by some general remarks on the country and its people* (illustrated).—The speaker described the general features of Chinese geography, language, and customs. Lingnan University (formerly Canton Christian College) is now 43 years old. It is more Chinese than the other fifteen Christian colleges and gives a typical Chinese education. It includes a university (with 300 pupils, including 50 girls), high school, primary, and kindergarten, with a total of 1100 pupils. Two thirds of the college staff of 75 are Chinese. The university has specialized in science and has the largest herbarium in China and large zoological collections. Like other Chinese universities, it is greatly hampered by the lack of published literature. The scientific organizations of China were mentioned and discussed briefly, and an account given of the explorations of Lingnan University in Hainan.

M. K. BRADY: *The Breeding of Salamanders* (illustrated).—This paper will appear in full in the Novitates of the American Museum of Natural History.

764TH MEETING

52ND ANNUAL MEETING

The 764th regular and 52nd annual meeting was held in the Assembly Hall of the Cosmos Club May 2, 1931 at 8:15 p.m., with Vice-President JACKSON in the chair and ten persons present. New member elected: S. W. GEISER.

The minutes of the last annual meeting were read and approved. The reports of the Recording Secretary and Corresponding Secretary were read and ordered placed on file. The recommendation of the Council that the Treasurer's report and the report of the Auditors be postponed until the first fall meeting was approved.

Dr. OBERHOLSER for the Board of Trustees stated that the status of the Permanent Fund is unchanged.

Mr. WALKER made an oral report for the Committee on Communications.

Messrs H. C. FULLER and W. H. BALL were appointed Tellers, and the election took place, resulting as follows.

President, H. H. T. JACKSON: *Vice-Presidents*, C. E. CHAMBLISS, C. W. STILES, T. E. SNYDER, H. C. FULLER; *Recording Secretary*, S. F. BLAKE; *Corresponding Secretary*, W. H. WHITE; *Treasurer*, F. C. LINCOLN; *Members of Council*, W. R. MAXON, A. A. DOOLITTLE, I. HOFFMAN, E. P. WALKER, T. H. KEARNEY.

S. F. BLAKE, *Recording Secretary.*

SCIENTIFIC NOTES AND NEWS

DR. HILMAR ØDUM, of the Geological Survey of Denmark, Copenhagen, was in Washington during part of September studying Eocene and Upper Cretaceous fossils at the National Museum and the organization and methods of the ground water division of the Geological Survey.

DR. ALEXANDER WETMORE has been elected a member of the California Academy of Sciences.

The first trial expedition of Aeroarctic in the arctic utilized the *Graf Zeppelin* during a six-days' flight of 8,000 miles leaving Berlin July 25 and returning July 30. The course was approximately Friedrichshafen, Leningrad, Archangel, Franz Josef Archipelago, Northern Land, Taymir, Novaya Zemlya, and return to Archangel and Friedrichshafen. LJUNGDAHL of Sweden, SMITH of the United States Coast Guard, and Lincoln Ellsworth representing the American Geographical Society took part in the magnetic observations which were in charge of LJUNGDAHL, the other two men assisting. There were 92 determinations of magnetic horizontal intensity obtained with the double-compass supplied by the Department of Terrestrial Magnetism and eight observations of declination with a Thomson compass. All reports indicate the trial expedition to have been an extremely satisfactory one and ECKENER has already assured the General Secretary of the Society of his desire to have the longer flight as originally proposed realized, if possible, next year.

For its International Polar Year Expedition the Canadian Meteorological Service has already received a special grant to apply this year for the purchase of instruments and for the preliminary arrangements. The main magnetic station will be at Chesterfield Inlet. Four or five other stations will be established principally for meteorological work.

The earth-current photographic registrations started at Tucson in March with the cooperation of the American Telephone and Telegraph Company, the Mountain States Telephone and Telegraph Company, the Coast and Geodetic Survey and the Department of Terrestrial Magnetism are continuing very satisfactorily.

The first of the coded messages regarding auroral display and intensity which are now a regular part of the daily URSIGRAM was received from College, Alaska, August 15 as applying to the date August 13.

The *Nautilus* of the Wilkins-Ellsworth Trans-Arctic Submarine Expedition left Bergen August 5 and arrived at Spitzbergen August 15. Owing to the lateness of the season it was not possible to cruise in the arctic ice longer than about three weeks. The vessel returned to Spitzbergen and after repairs proceeded to Norway. In the scientific staff were B. VILLINGER who spent some three weeks with Dr. VENING-MEINESZ in the study of the gravity apparatus, Dr. SVERDRUP of Bergen and F. M. SOULE of the Department of Terrestrial Magnetism.

Dr. and Mrs. JOHN C. MERRIAM after spending the greater part of the summer in Europe returned to Quebec August 26 and proceeded directly to California.

J. M. STAGG of the British Meteorological Office came to Washington July 25 to visit the Department of Terrestrial Magnetism and discuss matters pertaining to the International Polar Year. He left July 31 to return home by way of Toronto. A letter written after he returned states that despite the unfavorable economic conditions he finds everyone is quite optimistic as regards the program of the International Polar Year.

Dr. J. E. I. CAIRNS who has recently received his degree at Trinity College resumed his work in the Department of Terrestrial Magnetism, June 29.